RAILROAD GAZETTE

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CONTENTS

Contributions

Normal Clear and Normal Danger Signals.

To the Editor of The Railroad Gazette:

The normal clear system of operating automatic block signals originated in 1871, the date of the first installation of automatic signals. This method was used exclusively until 1891, when the first normal danger circuit was tried. This new system gradually won adherents and of late years much has been written favoring either the new or the old system. The arguments of those who have written in favor of the normal clear system may be summarized as follows:

1. A false clear indication is as liable to be given under the normal danger system as under the normal clear.

2. The normal danger system uses more line wire and contact points and so is more liable to get out of order and more expensive to install.

3. The signals on double track roads can be more easily inspected from the rear of a train under the normal clear system than under the normal danger.

4. The fact that there is a larger number of signals installed on the normal clear system shows that there are many who believe this system to be the better.

5. The normal danger system employs normal clear circuits plus additional complications.

6. The cost of operation under the normal danger system is only a trifle less than under the normal clear.

First.—A false clear indication is less liable to occur under the normal danger system than under the normal clear. The accumulation of ice and snow on the bearings upon which the blade of a semaphore signal moves has occasionally frozen so as to stop any movement of the blade. If this blade stands normally in the clear position the freezing will naturally keep it in that position. If it stands normally in the stop position the freezing will keep it there. Electro-pneumatic signals have failed in the clear position on account of the freezing of the valves which control the escape of the air. Electric motor signals have failed in the clear position from the accumulation of frost on the clutch magnets. All these failures from freezing or frost difficulties tend to hold the signal in the position in which it normally stands. Should it normally stand in the clear position these checks to movements will hold it clear, and pave the way for a tail-end collision.

Second.—That the normal danger system uses more line wire and so is more liable to get out of order and more expensive to install is partially untrue. In all recent double track installations of signals with normal danger "wire" circuit only one line wire has been used for the distant signals, the same as required for the normal clear "wire" circuit. Where distant signals are not used no line wire is required for the signal circuit. The normal danger circuits for single track protection require less line than do the normal clear. "Wireless" circuits are quite as practicable under the normal danger system as under the normal clear. There is at present being installed on the Central Railroad of New Jersey a system of home and distant signals on the normal danger plan which requires absolutely no line wire. One and sometimes two back contacts are used in a normal danger circuit which would be unnecessary under the normal clear system. Since the amount of line wire is the same and the additional contacts are few the initial cost and complexity of the two systems are nearly equal.

Third.—That signals on double track roads can be more easily inspected from the rear of a train under the normal clear system than under the normal danger seems questionable. On the track on which the train is running the conditions are identical under both systems as the signals should be at danger behind the train. Hence what force the argument has applies to one track alone. Under the normal danger system failures at danger caused by the track circuit (and a vast majority of the signal failures are from this cause) can be readily detected by seeing the next signal in the rear held at clear with no train in the clearing section. Under the normal clear system failures at danger can be readily detected, but failures at clear cannot be seen. Under the normal danger system failures at danger cannot always be detected, but failures at clear can be easily seen. Thus this rear end inspection discovers only the minor or delay-causing failures under the normal clear system, but it is sure to find the dangerous or wreck-causing failures under the normal danger system. Should the circuits be properly inspected on the ground one system is as easily tested as the other, although this fact is not understood by those unfamiliar with normal danger circuits.

Fourth.—That there is a larger number of automatic signals installed on the normal clear plan than on the normal danger and that many people believe the former to be the better system is undoubtedly correct. But other facts should be borne in mind before drawing an inference from this statement. In a progressive science the argument that one system is better then another because it has been used more is of little value. A few years ago the same argument could have been advanced for the clock work signal over all automatic signals, yet its mechanism had to be daily wound up. Automatic block signals have been installed for over 30 years, and it is only during the last 11 years that the normal danger system has been developed. The one company supplying either system indiscriminately, has installed 69 per cent. of its signals under the normal danger system, and it would seem that a majority of those having an equal choice between the two systems had chosen the normal danger.

Fifth.—The old argument that normal danger circuits are merely normal clear plus additional complications is probably no longer used. The "wireless" normal danger circuit now being installed on the Central Railroad of New Jersey is perhaps the most striking answer to that argument.

Sixth.—The cost of operation under the normal danger system is only a trifle less than under the normal clear. The statement that it is somewhat less has probably never been questioned. If we assume that a signal is in the clear position four hours a day under the normal danger system, and this would imply very heavy traffic, and at clear 20 hours per day under the normal clear system, it is plain that there is a draft on the electrical energy to hold the signal clear five times as long under the normal clear plan as under the normal danger. Thus to bring the cost of operation of normal clear signals approximately near to signals operated on normal danger circuits it is necessary to employ extremely high resistance clutch magnets. These high-wound coils necessarily make the circuit more susceptible to lightning, chilled batteries and the permanent magnetization of the magnet cores and hence more easily deranged. It is also practicable, with the normal danger system, to use a normal open track circuit which can be operated with either potash or gravity batteries. If potash batteries be used the cells will operate without renewal from six months to a year, dependent on the amount of traffic. On normally closed track circuits where gravity batteries have been used it has been found advisable by most signal engineers to have the batteries cleaned once in two weeks and renewed once each month. The economy of this normal danger circuit is so obvious as to need no further comment.

The normal danger system is a surer protection than the normal clear because stoppages by frost or freezing tend to hold the signal "stuck" in the position in which it normally stands. It is more reliable, efficient and more easily maintained because high resistance magnet coils are unnecessary, lessening the greater dangers of lightning and residual magnetism and decreasing the failures from chilled batteries.

The normal danger system is only slightly more expensive to install than the normal clear, since it uses the same number of track sections and line wires, and is admittedly much more economical to operate. The additional cost of installation is usually less than the amount saved in operation during the first year of service.

It is easier to inspect for dangerous failures. It helps track workers and section men by indicating the approach of a train and gives time for hand cars to be removed from the tracks. A minor but somewhat attractive feature of the normal danger system is its convenience for the passengers, the customers of the road, while standing on the platform or hurrying to meet a train. The position of the blade shows the approach of a train and they soon learn to recognize and rely upon the indication. This is not a theory, it is a fact observed on roads on which the normal danger system is in use. Section men, passengers, everybody knows whether or not a train is coming.

Automatic intermediate signals between manual block towers can be operated on the normal danger plan without change in locking circuits or in operating regulations. Since the interlocking and manual signals are kept normally at danger the same system applied to automatic signals obviates the necessity of new rules and practices when these signals are installed.

It is a suggestive fact that many railroads, after using the old normal clear system for years, have changed to the normal danger. That its superiority has been broadly recognized is shown by the fact that although invented but a few years ago and installed by only one signal company, one-third of the automatic block signals in the United States are operated on the normal danger system.

D. B.

Maintenance of Air-Brakes Under Freight Cars.*

On the Intercolonial Railway, we aim to give every freight car air-brake on the road a general overhauling once a year. To get this result, we cannot confine our operations to repair tracks, and we find an ideal place to reach the cars is on the loading and unloading tracks of the freight depots at our larger terminals, where cars stand for hours and sometimes days. We have already installed air plants at some of these points, and will in time have all of them thus equipped, so that the work is thoroughly tested. We thus avoid much delay to freight trains from holding them for air-brake repairs. We are doing this work at five such points, and are employing 14 men working in pairs.

Of course we cannot do this work in the winter season; we therefore get at it as soon as possible in the spring, and work until all the freight equipment has been gone over. As an example, at St. John, N. B., we extended the air plant to reach the freight depot tracks, and located the piping to reach 10 tracks, holding altogether 300 cars, so there are always plenty of cars to work on. We use 1¼-in. pipe, locate the hose boxes about 100 ft. apart and carry 90 lbs. air pressure. We put two men at work there, who do nothing else during the season but test and overhaul air-brakes on these tracks. We are now equipping such points having air plants with the Westinghouse triple valve testing devices for cleaning rooms and yard carts.

The men work under the various terminal foremen, and we keep them supplied with all repair parts required. They have been specially instructed for this work, and have become very proficient. They stencil their work on the side of the auxiliary reservoir, giving letter designating place and the date—for instance, St. J., 20-8-03. This stencil covers the following work done:

Triple valve cleaned and oiled or changed.
Brake cylinder cleaned and oiled.
Pipe clamps and cylinder blocks tightened.
Piston travel adjusted.
Hose tested with soap suds, and couplings and gaskets tested and renewed if required.
Angle cocks, cut-out cocks, release valve, and retaining valve tested and required repairs made.
Pipe work tested and repaired if required, and brake-shoes applied if needed.

Every brake gets a general overhauling if in service one year since the last stencil mark, or in any case if the test shows that it requires it. The result of one season's work at that point, which is fairly indicative of the work done at all such points, is as follows:

Eight hundred and fifty-five brakes received a general overhauling, and were turned out in first class condition.

The material used cost.....	$241.00
Labor	390.00
Total	$631.00

An average cost of 73.8 cents per car, which does not include cost of brake-shoes. Besides the work done at the five points spoken of, the usual air-brake running repairs are carried on at the repair shop and tracks. A form for keeping record of these general repairs to all our air-brakes is sent in by the terminal foreman at the end of each month. A set of car record books, enough books to index every car on the system, is kept in which the foremen's reports are copied. Each book will index 4,000 car numbers and for this system of air-brake records will last 10 years. We are thus able to tell just when and where any car on the road had its air-brake overhauled, what was done to it, and when it is due to be again overhauled. We are also able to keep a record of air-brake work done to foreign cars which serves as a check on bills for such repairs. In tracing up responsibility for slid flat wheels and damage to lading or draft-gear the record is also very valuable as a time saver.

For our system of keeping daily check on the condition of freight car air-brakes running on the whole system we use three printed forms, the air-brake defect card; the conductor's report of condition of air-brakes; and a third form which is simply a printed letter with a few blank spaces to fill in.

The air-brake defect card is only to be used to indicate defects in the air-brake when found, but the second

*Extracts from a paper read at the October meeting of the Canadian Railway Club, by W. C. Hunter, Intercolonial Ry.

mentioned form, the conductor's report of condition of air-brake, is sent to the General Air-Brake Inspector for every freight train run, no matter what the condition of the brakes are.

While this form is very simple and condensed, it at the same time covers a great deal of information. By its use one is able to tell just how many freight car air-brakes are in operation on the road each day, just how many were in good order, just how many were bad and cut out, on what part of the system the most trouble occurs with the brakes, and what it consists of. The freight train conductor makes a correct report of any trouble which may have occurred with the air-brakes on the trip. It encourages them to report anything, however small, that may come to their notice. The use of the form necessarily requires inspection of the train en route, and it follows that defects are discovered where they exist, and are carded with a defect card. Conductors are required to know of and report slid flat wheels on this form. Conductors are required to make out this form in duplicate, and one copy goes to the Car Inspector at the terminal on arrival, who is thus notified of the condition of the air-brakes on the train, and therefore has no excuse for failure to see any defect cards which may be on the cars.

The third form referred to serves merely to keep a check on defect cards and repairs made in accordance with them, as shown on the stubs. These stubs are kept in the General Air-Brake Inspector's office, and at the end of each month the cards which have been received from the repair men all over the railroad are matched with the stubs, and if any stubs are left over without cards having arrived to match them, this form is filled out from these stubs and sent to the Master Car Builder, who signs it, and sends it to the parties who received the cars, according to destination written on the stubs, and who should have made the repairs and sent in the defect card. The result is that all car inspectors and car foremen now find that the General Air-Brake Inspector is watching every defect, and that every conductor is helping him by discovering and reporting the same, and that these reported defects must be repaired. Failure to repair them will be noticed, and an explanation will certainly be called for, as requested on the form.

The New York Terminal of the Pennsylvania Railroad.

In the *Railroad Gazette* of last week, the general scope of the Pennsylvania terminal improvements in New York City was outlined, and a somewhat detailed description given of that portion between the Hackensack Meadows, in New Jersey, and the State line in the middle of the North River. This article will describe the remainder of the work which includes the tunnels from the middle of the North River under Manhattan and the East River to Long Island City. The Pennsylvania, New York & Long Island Railroad Company will build this part of the undertaking, which is divided into two sections to be let under separate contracts; one including the lines west of the terminal in New York City at Ninth avenue, and the other including all the tunnels east of the terminal, leading to Long Island City. The plans and profile for the western section were shown last week in connection with the section in New Jersey. The profile for the eastern section is shown in Fig. 1, together with a key map showing the location of the line under the streets. These two general sub-divisions will hereafter

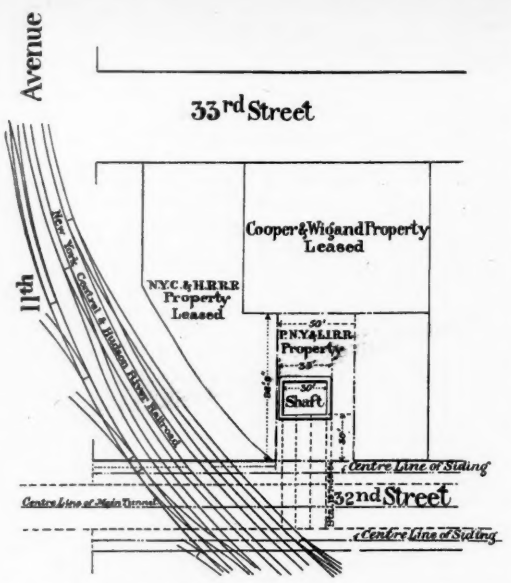


Fig. 2.—Site of Manhattan Shaft at Eleventh Avenue.

be designated as North River division and East River division respectively.

The North River division is divided into two sections, Gy and H. The latter includes only the sinking of the Manhattan shaft at 11th avenue and 32nd street with the cross drifts or headings to connect it with the tunnel under 32nd street. The contract for this work has already been let and work is now in progress. Section Gy includes all the rest of the tunneling and sinking of shafts for this division.

Starting from the western end of section Gy under the North River the construction of the tunnel will be exactly similar to the work already described for the cast-iron lined tunnels in section Gj. At this point the grade of the tunnel is .529 per cent., which grade continues to a point about 700 ft. east of the State line. From here on to a point between Ninth and Tenth avenues the grade is 1.92 per cent., the increase in gradient being made on a vertical curve with a radius of about 28,700 ft. At a point 400 ft. east of the end of section Gy

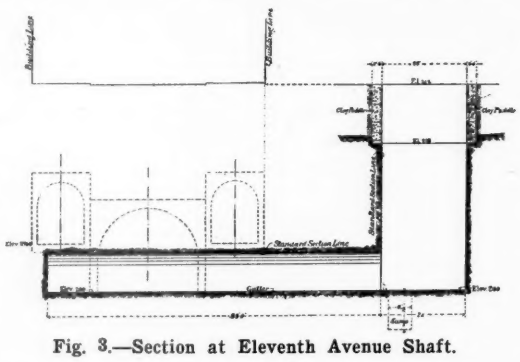


Fig. 3.—Section at Eleventh Avenue Shaft.

the grade is decreased to four-tenths of 1 per cent., which is the grade preserved in the terminal station between Seventh and Ninth avenues. In this section of the work the least distance between the surface of the ground and the top of the tunnel is 20 ft., at the west end of the four-track tunnel. Where the tunnel passes under the bulkhead line on the New York side, a short section, 37½ ft. long, will be built with cast-steel lining, to resist the weight imposed by the bulkhead above. The pile foundations will be carried in 605 ft. from the bulkhead line, because of the nature of the foundation, which is soft and composed chiefly of silt. A section 285 ft. long adjoining, will be similarly lined with cast iron, but will rest on a solid foundation. Both tubes will open into shield chambers 27½ ft. long. Then follows a section 75½ ft. long, of 20-ft. span, twin tunnels. Adjoining this is a 34-ft. span, two-track tunnel, 130 ft. long, which opens into a three-span tunnel containing the two main line tracks in the center and siding spurs in single track galleries on each side. This part of the tunnel is 1,096 ft. long and opens into a four-track tunnel under one arch, 605 ft. long, which terminates under Ninth avenue. On the plan which was shown last week the line is shown as a tangent from the Bergen Hill portal to a point about 200 ft. west of the New York pier-head line, where there is a very slight curve of 30 min. (radius 11,459 ft.). From here on the line is a tangent running under the center of 32d street. The length of the sub-aqueous tunnel between shield chambers is 5,947 ft.

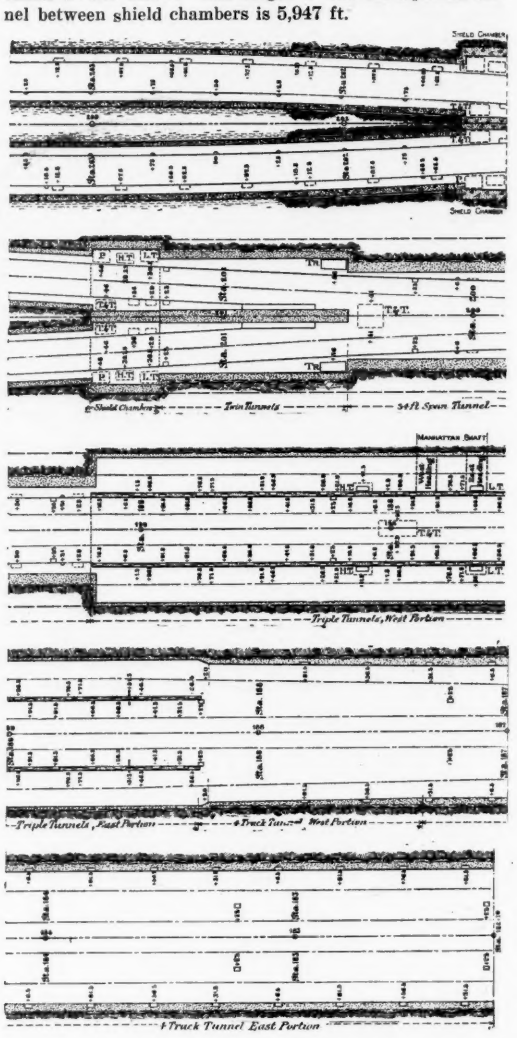


Fig. 4.—Plan of Tunnel Sections.

The work on section Gy will be carried on from two points. Shafts will be sunk at Ninth avenue between 31st street and 32d street and at Eleventh avenue between 32d street and 33d street. The location of the 11th avenue site is shown in Fig. 2. From the opening at 11th avenue two headings will be driven through the rock into the triple tunnel at that point, and work carried on in the tunnel in both directions from these headings.

Fig. 4 is a plan of the tunnels at different points between the bulkhead line and the terminal. As will be seen, the lines in the twin tubes under the river begin to converge just west of the shield chambers, and, passing through the shield chambers the arches are supported by a concrete dividing wall, forming a twin tunnel. They become exactly parallel at the eastern end of the 34-ft. span tunnel and continue thus to the terminal. The triple tunnel and the four-track tunnel accommodate both main line tracks and two sidings. From the terminals all four tracks are carried on the same grade to the point where the main line commences to descend on a 1.92 per cent. grade. At this point the sidings commence to descend on a 1 per cent. grade, which causes them to be about 11 ft. above the main line level at the western end of the triple tunnel. This difference in grade necessitates a difference in the successive arches for practically the

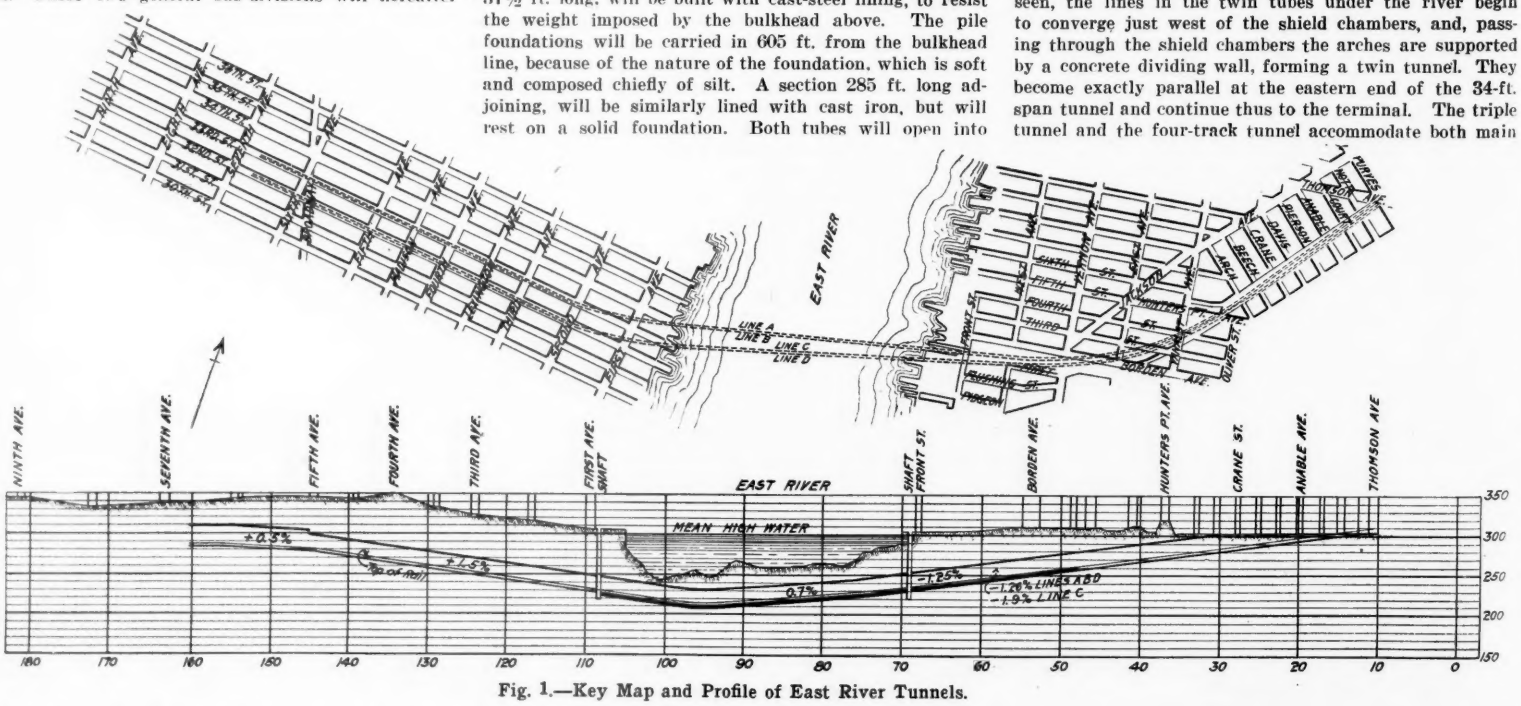


Fig. 1.—Key Map and Profile of East River Tunnels.

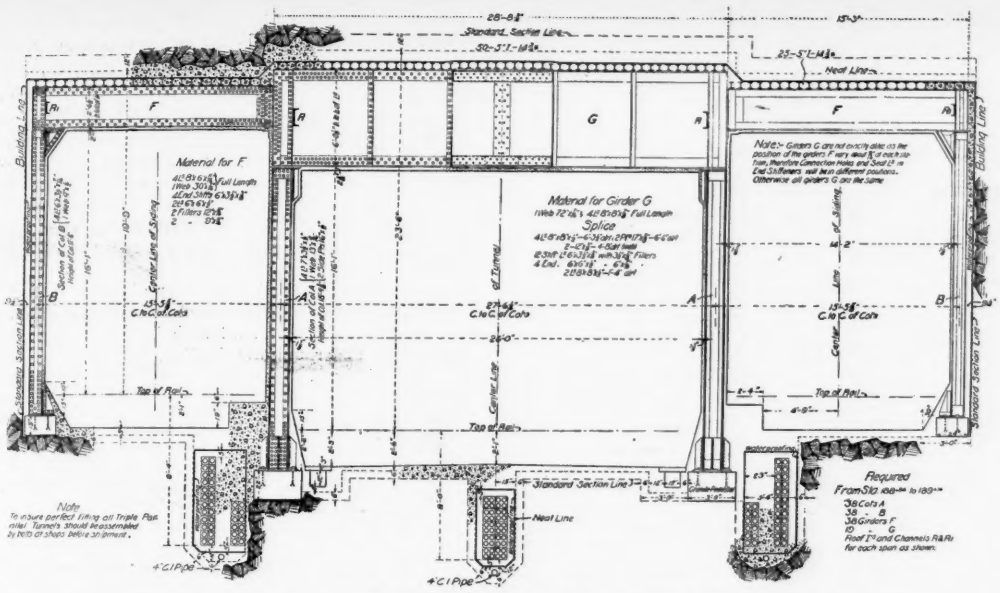


Fig. 5.—Section of Triple Tunnel at the Eastern End.

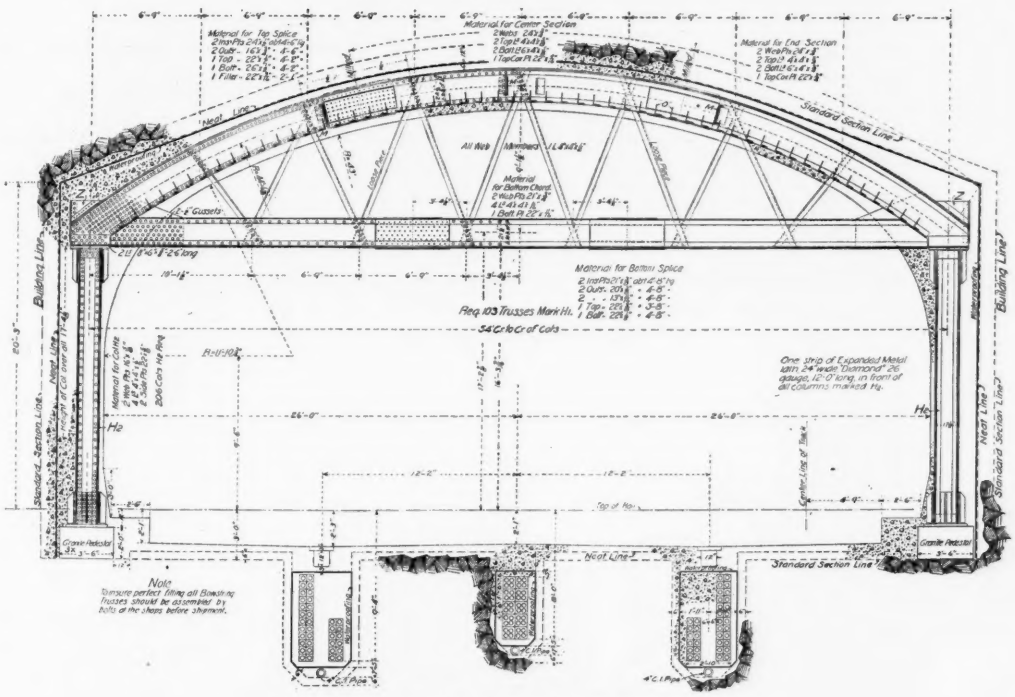


Fig. 6.—Section of Four-Track Tunnel.

crete. The relative location of the conduits for power and telegraph wires will be the same as in the triple tunnel.

Fig. 7 shows a section of the 34-ft. span, double-track tunnel. This will be a full circular arch lined with brick masonry 3 ft. thick. The low and high-tension conduits will be imbedded in the concrete just above the floor level and benches similar to those shown in the lined tunnels will be formed for the safety of passengers.

All of the work in this section is expected to be done without disturbing the surface of the streets above. In the tunnels driven without shields, small advance headings are to be run on the lines of these tunnels, and from these headings various full section headings are to be worked. The shaft near the North River will be an open excavation with concrete and steel retaining walls at the top, and will be connected by two cross drifts with the line of the tunnel under 32nd street. In this shaft a permanent sump is to be formed for drainage. The two cross tunnels to be built will be 86 ft. long, 10 ft. wide and 10 ft. high at the center and 7 ft. high at the sides. The shaft at Ninth avenue will be on a portion of the site of the company's terminal station. The contract calls for an open excavation about 140 ft. long by 197 ft.

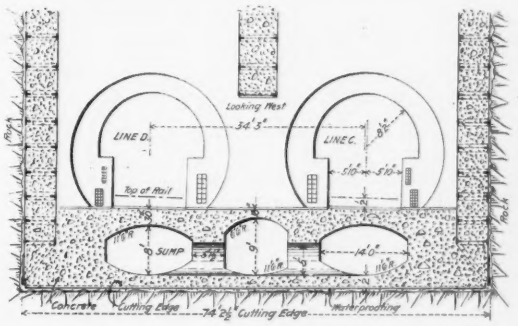


Fig. 12.—Section at Foot of Manhattan Shaft.

wide, sunk to the depth of the tunnels at this point. From this shaft a drift, or drifts, will be carried into the line of the tunnel and work carried on through these drifts. If in any portion of the work it is found that tunnel excavation is extremely difficult or impracticable, the contractor may, with the consent of the engineer, apply to the proper authorities for a permit to open the street and construct such portions in open excavation.

The line as proposed will penetrate immediately under Pier 62, North River, which is used by the New York Central & Hudson River Railroad as a freight house. In order that there may be no danger from encountering any pile foundations of this pier or supporting the weight of it on top of the tunnel, the Pennsylvania Railroad has obtained a lease of it, and previous to the construction of the tunnel it is to be dismantled and removed. All of the piles on the line of the proposed tunnels will be withdrawn. Where the tunnel passes under the bulkhead line at Pier 62 every precaution is to be taken to maintain the superstructure of the bulkhead and avoid injury to the tunnels. The contractor is to be held liable for any

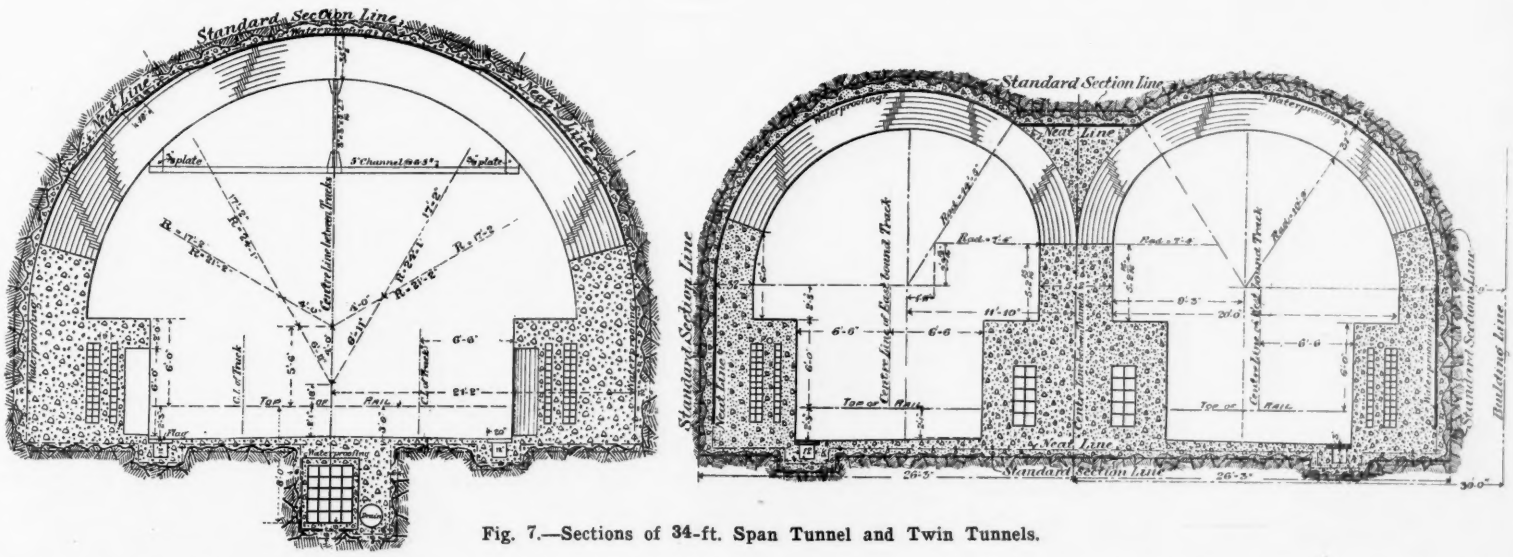


Fig. 7.—Sections of 34-ft. Span Tunnel and Twin Tunnels.

entire length of the triple tunnel. Fig. 5 shows a section of the triple tunnel at the eastern end, where the main line and siding tracks have a difference of level of about 2 ft. The main line span will be 27 ft. 6¼ in., center to center of columns, and the roof will be supported by plate girders 6 ft. ½ in. deep. The siding galleries will have a span of 15 ft. 5⅜ in. center to center of columns, the roof will be supported on similar plate girders 2 ft. 6 in. deep. As shown on the section, the roof will be of concrete with steel I beams imbedded in it and resting on the girders. A waterproof covering of felt paper and pitch laid in alternate layers will be laid just on top of the I beams, and will extend clear across the roof and down the sides of the tunnel. The columns supporting the roof girders will be built up of plates and angles and the two center ones will rest on granite blocks 3 ft. square x 22 in. high. The lighter columns supporting the outside end of the gallery girders will rest on similar blocks 15 in. high x 24 in. square. Telegraph and telephone wires will be carried in tile conduits set in a trench in the rock in the center line of the tunnel below the floor. High-tension wires will be carried in similar conduits just outside the main columns and below the floor line of the side gallery. Low-tension wires will be carried in a similar conduit below the other siding gallery. All of these will be imbedded in concrete, and a 4-in. drain pipe will be carried in the concrete below each conduit.

A typical section of four-track tunnel is shown in Fig. 6. Here all of the tracks are carried on the same level. The roof will be supported by bow-string girders resting on built-up columns forming a 54 ft. span. These columns will rest on granite pedestals 3 ft. 6 in. x 2 ft., bedded on the solid rock. The roof and sides of the tunnel will be concrete to the thickness shown on the section, the top chords of the girders being imbedded in the concrete failure of the bulkhead wall to preserve its original shape or level for 12 months after the acceptance of the work by the engineer. The iron lining in the tunnel for a distance of 6 ft. on each side of the bulkhead wall will be replaced by a cast-steel lining to provide additional strength.

The East River division extends from the east end of the terminal site at Seventh avenue to Long Island City and is divided into six sections, A, B, C, D, E, and F. It consists of two parallel double-track lines carried in single and double-track tunnels on approximately the same level. One double-track line is to be carried under 33rd street and the other under 32nd street from the terminal to the East River, where all the lines will cross in single track tubes. For a short distance after leaving the terminal, three tracks will be carried in each tunnel. This part of the line is on a grade of 0.5 per cent. Where the three tracks converge into two the grade increases to 1.5 per

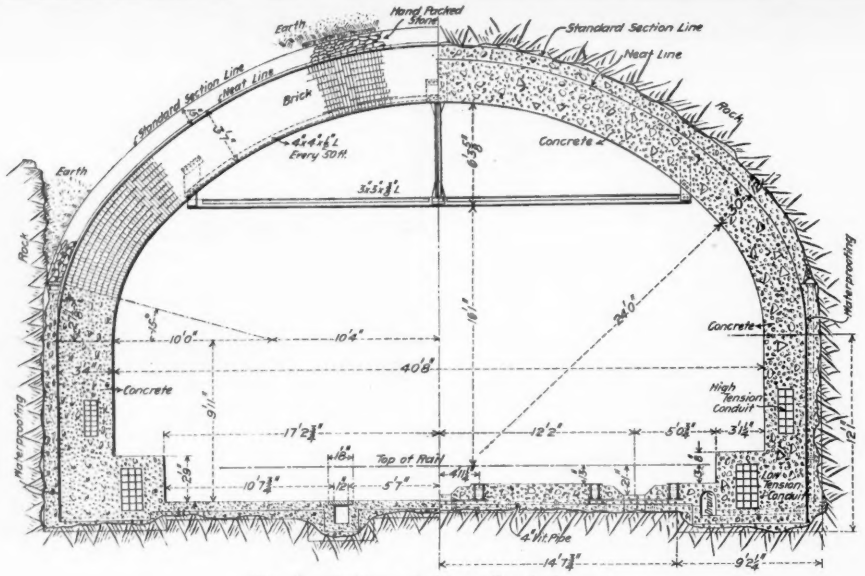


Fig. 8.—Section of Three-Track Tunnel.

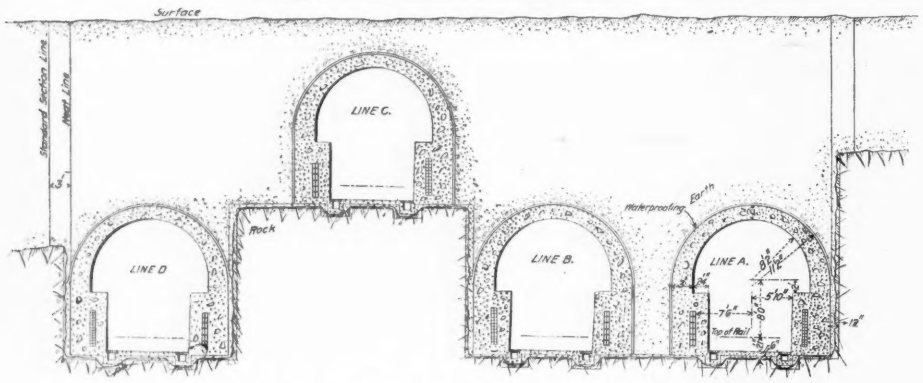


Fig. 10.—Section of Single Track Tunnels, Long Island City.

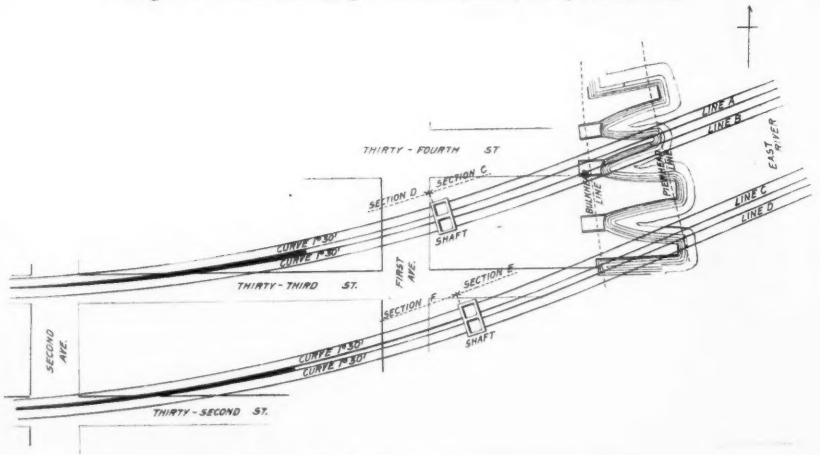


Fig. 11.—Plan of Tunnels at Manhattan Shaft.

cent., which continues to a point about 900 ft. east of the Manhattan shaft, where the line begins to rise 0.7 per cent., increasing to 1.25 per cent. at the Long Island shaft. Under 32nd and 33rd streets the line is a tangent but at First avenue it turns on a 1 deg., 30 min. curve, crossing under the river as a tangent and again curving on the same degree on the other side. Where it emerges in Long Island City there will be a long concrete-walled cut from four to seven tracks wide. The whole work is expected to be carried on without disturbing the surface of the streets except the tunnels from the Long Island shaft to the open cut.

Fig. 8 is a cross-section of the three-track tunnel. Half of the section shows the construction for brick arch surrounded by loose earth. The other half shows the construction in solid rock with concrete arch and track supportd on steel I-beam stringers. Both the concrete and brick arches will be 2 ft. 6 in. thick and circular in shape on a 24-ft. radius.

Fig. 9 is a typical cross-section of the twin tunnels. The arch masonry will here be 1 ft. 10 in. thick to the neat line. At the shafts at each side of the river these twin tunnels will separate into two cast-iron lined tube tunnels similar in every way to those under the North River, except that they will not be supported on piles, as the foundation on the river bed is considered firm enough to support the loads. These tubes will be driven with shields from both sides of the river. Fig. 10 shows a section through the four single-track tunnels about under Third street, Long Island City. Line C at this point is higher than the other three and emerges to the surface a short distance beyond. This section of the tunnels will be built by the cut-and-cover method.

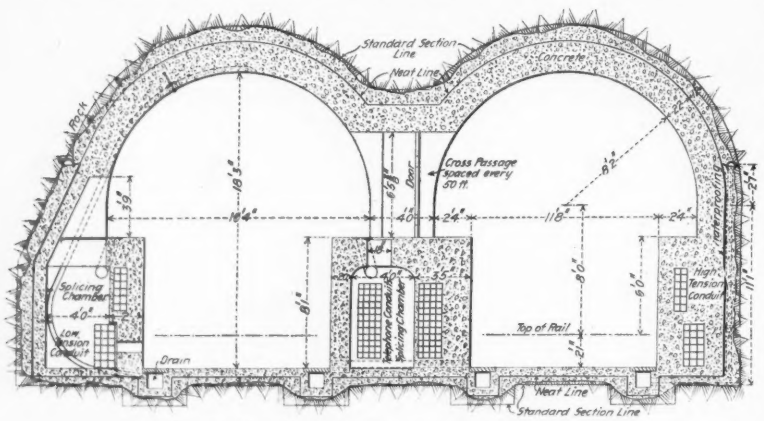


Fig. 9.—Section of Twin Tunnels, East River Division.

The shafts on both sides of the river will be sunk with caissons and will be lined with concrete with a dividing wall in the center of the well. A section of the Manhattan shaft as completed is shown in Fig. 11. These shafts will have permanent sumps for drainage as shown in the drawing.

The specifications for these two divisions of the work, with the exception of the changes made necessary by the difference in method of construction, are practically the same as those for the section of the work described last week. Alfred Noble is the chief engineer in charge of the East River division.

Concrete Reenforcement.

By JULIUS KAHN, *C. E., Assoc. M. Am. Soc. C. E.*

It is fairly well recognized among engineers that vertical reenforcement for concrete beams is quite as essential as the horizontal reenforcement, and in many cases the horizontal rods are surrounded by U shaped stirrups of band iron or twisted rods. It was noticed at first by European engineers that a concrete beam, when tested to destruction under uniform loading, invariably failed by shear at the ends, the lines of rupture corresponding closely to the lines of principal compressive stress for such a beam.

The writer has also made a number of tests on beams reenforced with plain and deformed rods on the bottom, and without one exception, all such beams when tested to destruction under uniform loading, failed by vertical or longitudinal shear.

The matter of vertical reenforcement is certainly of more importance than some American engineers have been willing to grant to it. To the writer it seems most natural that rupture should occur in this manner; in fact, he can hardly conceive of its occurring in any other way. It must, of course, be remembered that a beam, when tested for both shear and bending moment, should be subjected to a uniformly distributed load, not to a concentrated center load; for, a beam loaded according to this latter method would only develop one-half the shear which exists in a uniformly loaded beam for a given bending moment.

Taking, for example, a beam shown in Fig. 1, and considering the cross section "AA."

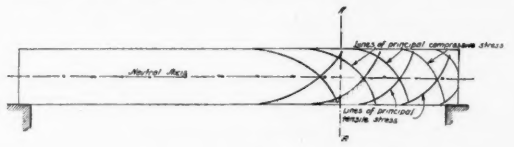


Fig. 1.

The tension on each fiber below the neutral axis varies in proportion to its distance therefrom. The vertical shearing strain is, however, practically constant. The resultant strain on any particle should therefore be a combination of these two components, producing a line of principal tensile stress, which is one of variable curvature from the bottom of the beam to the top. This theory of lines of principal tensile stress in a beam of granular composition was, of course, advanced by Rankine many years ago, and to the writer's knowledge, Captain Sewell was the first to make public the very close relation between the theory and actual tests in re-enforced concrete beams, when these were loaded to destruction. The photograph, Fig. 2, shows such a failure where the slab is reenforced, longitudinally only.

If, then, lines of principal tensile stress exist throughout a beam, it is most natural that the concrete, being weak in tension, should open up at right angles to these lines, and this is what has occurred in all the tests which the writer has observed in well proportioned concrete steel beams, when tested to destruction under uniform load, and where the metal reenforcement was horizontal only.

As has already been noted, European engineers endeavored to overcome the difficulty by placing stirrups throughout the beam, their distances apart varying, of course, in the inverse ratio of the shear. There seems no doubt whatever in the writer's mind that such stirrups accomplish a great deal of good, as they cross the lines of rupture at an angle, and tend to hold the material together.

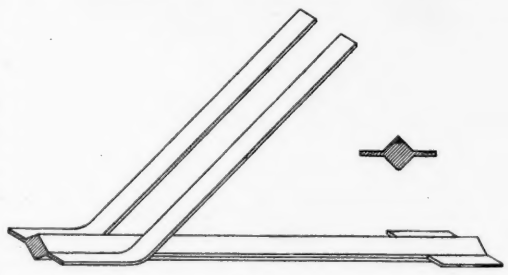


Fig. 3.

If, however, they are placed in a beam, they should be placed in a direction inclined to the horizontal, so as to lie more closely along the line of principal tensile stress, for if they lie in exactly this line, they also cut the actual line of rupture at right angles, and are therefore of maximum efficiency in holding together the concrete where its natural tendency is to open up. Furthermore, if such stirrups are to carry stress, they should carry it into some member capable of receiving it, and the bottom chord member or the horizontal reenforcement is there for that purpose. Stirrups should be inclined to the vertical and preferably bent to a curvature to approximate the line of principal tensile stress, and secondly, these stirrups should be rigidly connected to the main horizontal reenforcing bar.

There is still another matter in connection with the steel reenforcement for concrete beams which is also of great importance, in so far as it affects economy in the use of steel. In a uniformly loaded beam, the maximum bending moment occurs at the center, whereas the maximum shear occurs at the ends, and if the same quantity of steel reenforcement is therefore placed along the bot-

tom of the beam and extends the full length of it, steel has been wasted so far as bending moment alone is concerned, and certainly the beam has been neglected so far as shear is concerned.

A steel I beam in the same manner is not an economical construction for uniform loading; its top and bottom flanges are only required at the center and at this place only a very thin web, whereas at the ends the stress is almost altogether shear, and web alone is required with very little of top and bottom flanges. In the system of concrete reenforcement, which it is the purpose of this paper to describe, these two matters have been carefully considered. The fundamental principles of this type of reenforcement are:

First.—Concrete should be reenforced in a vertical plane, as well as a horizontal one.

Second.—The reenforcement should be inclined to the vertical, preferably with varying upward curvature, approximating the line of principal tensile stress.

Third.—The metal should be distributed in proportion to the strains existing at any place.

Fourth.—The shear members should be rigidly connected to the horizontal reenforcement steel.

All of these results have been accomplished by taking a bar of cross section, as shown in Fig. 3, and shearing the web upwards into an inclined position on both sides of the main body bar, thereby forming substantially the tension members of the ordinary Pratt truss.

When such a structural member is embedded within a body of concrete, the latter unites firmly to the steel, and the combination of the two forms a trussed beam wherein the tensional members are made up of steel, and the missing compression members supplanted by the concrete. Concrete is excellent in compression; steel, in tension; and, because of the property of strong adhesion between the two, their combination makes an ideal beam.

Neglecting for a moment the matter of vertical reenforcement, it is evident that a bar sheared up as above described, cannot possibly slip through the concrete. The writer has actually taken blocks of concrete, moulded to form the voussoirs of a flat arch, and then set them between the prongs. Such a beam, though set up without a particle of mortar between the joints, will carry a very large weight, and were it not for the large deflection which is caused by the poorly fitting surfaces between the prongs and the blocks, such a beam would carry weights to the same extent and on the same principle as when steel and concrete are actually united together. This presents another way of looking at the reasons why this method of reenforcement is so efficient. As soon as a load is applied on top of the beam, the concrete tends to arch itself, and a series of internal arches immediately set themselves up within the material, each arch finding its abutment in a set of prongs for which the bottom chord acts as a tie. The prongs receive the weight and carry it upwards, distributing it on the other arches of larger span, the horizontal reenforcement serving as a common tensional member.

It is plainly evident that with this construction the horizontal member might actually be placed outside of the concrete entirely, and the adhesion of the concrete to it entirely neglected, the strains coming into it being so largely the horizontal components of the inclined members. Of course, for fireproofing purposes, and to prevent rusting, it is more advisable to imbed the steel within the concrete; and when this is done, advantage may be taken of both the adhesion of the concrete to the main bar and to the sheared up members. In fact, with a given amount of concrete, a maximum amount of steel may be used, since the strains which it takes up are due to the direct adhesion of the concrete to it, plus the horizontal component of the inclined members. When such a beam fails, assuming that good material has been used for its construction, one of two things must happen—either the steel pull in two, or the concrete crush on top. The top portion of a concrete beam when used in floor construction, is largely the floor itself, and it is generally impossible for this to fail in compression. It would seem, therefore, that a very large quantity of steel could be placed in the bottom of the beam to balance the compression. In fact, in all tests which the writer has made up to date, he has pulled the steel in two at the center of the beam.

Another point of great advantage of this construction is the fact that a beam need not necessarily be very wide to carry a given load; depth alone counts to advantage. The steel reenforcement, depending entirely upon the stresses coming into it from the sheared up members, may be one large bar. This is practically impossible with constructions wherein the stresses coming into the steel are due to adhesion only of the concrete to it. Where such adhesion is depended upon, a large body of concrete must surround the steel to be able to transmit all of the strain which the bar is capable of taking. Whatever strain exists in the steel must be transmitted into the upper portion of the concrete through the medium of the concrete immediately surrounding it, and any one can readily perceive the extent of the horizontal shear, which must therefore exist throughout the body of the concrete, and the necessity of giving the beam great width. With this new method of concrete reenforcement, however, the beam may be comparatively narrow; at the bottom it needs only to be sufficiently wide to encase the steel. It should taper upwards, however, widening towards the top, so that sufficient area may be given to the concrete to receive the compression. This, of course, makes a great saving in the amount of concrete used. The strength of steel is, of course, a definitely determined matter. The concrete is not very expensive, and it would be advisable in all cases to give a small surplus of this material on the top of a beam, so that it will not fail by compression. With shear thus properly cared for, there is only one way in which the beam can possibly fail, and that is by the parting of the steel.

Where this result can be assured with certainty, a concrete beam need no longer be subjected to a factor of safety of 10; the ordinarily adopted factor for steel of 4 is sufficient, as such a beam is entirely dependent upon the steel and should be subject to close calculation in the same manner as a steel I beam or truss.

In general, whenever concrete is depended upon to carry other strains than direct compression, more or less risk is being assumed, and a large factor of safety is strongly recommended. Figs. 4 and 5 show tests on two reenforced concrete beams, of 26 ft. span, center to center

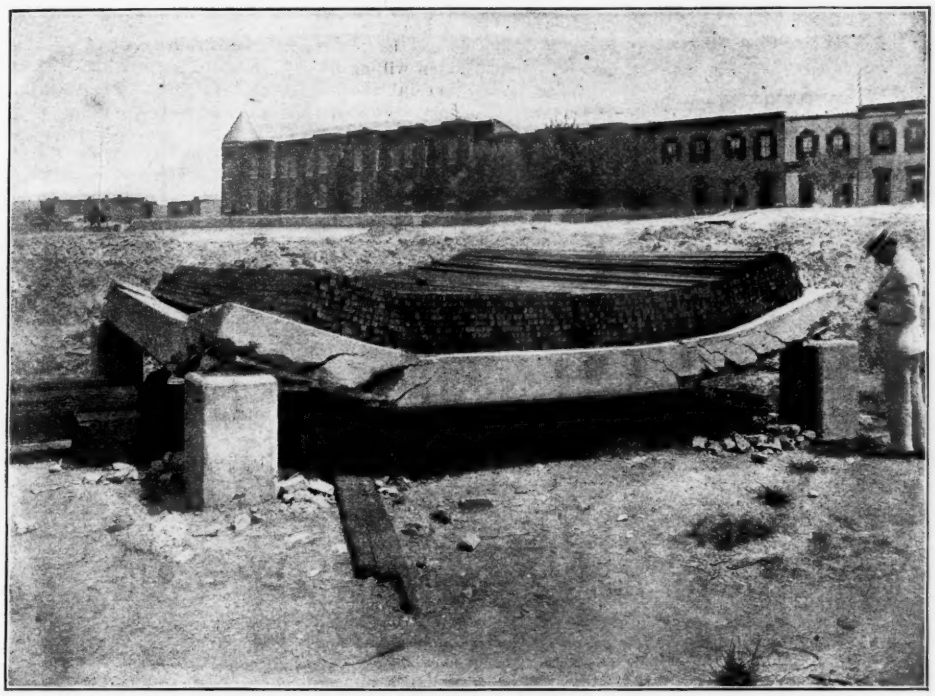


Fig. 2.

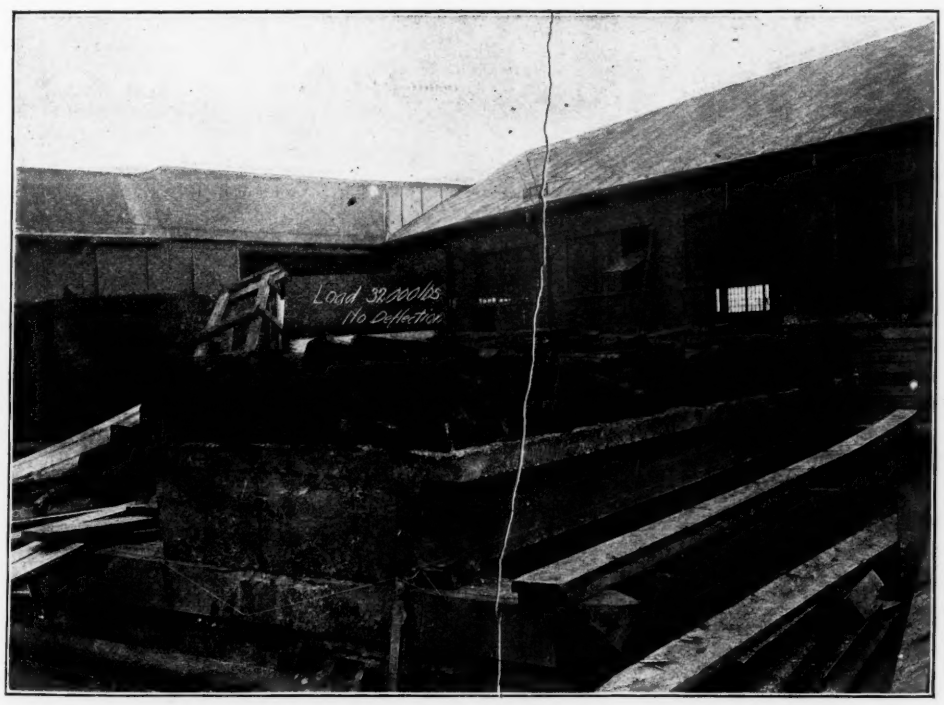


Fig. 5.

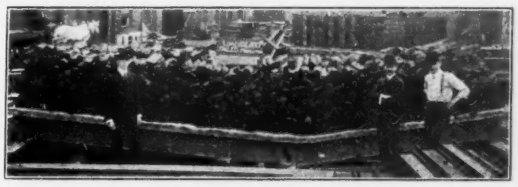


Fig. 4.

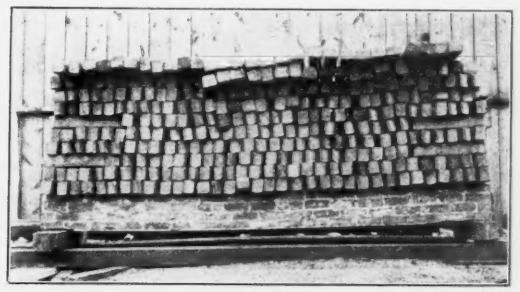


Fig. 6.

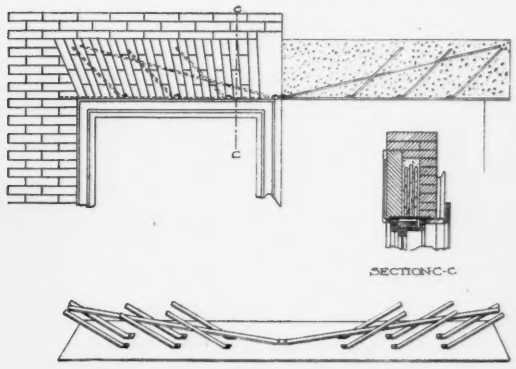


Fig. 7.

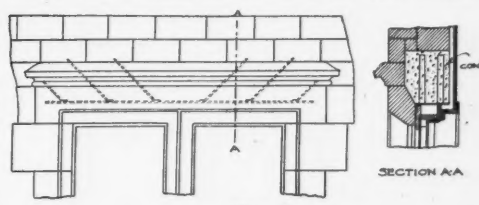


Fig. 8.

of supports, with a 4 in. thick concrete slab 5 ft. wide on top to receive the load. The concrete was made of Portland cement, sand and crushed stone, proportioned one, two and five. Loading was done with pig iron and deflections measured at the center. In one of the photographs an outline is shown of the actual cross sections of the beams. The ends, it will be noted, are built up solid to give better bearing on the supporting timbers. The area of metal in the bottom of each beam was 2 sq. in.

No deflection could be observed in the beams until the load had reached 49,000 lbs. When 84,000 lbs. of pig iron had been loaded on the beams, making a total weight of 93,000 lbs., the floor slab, weighing about 9,000 lbs., the actual deflection was ⅝ in. It was evident that the elastic limit of the steel had been well exceeded by this time. With 101,000 lbs. of pig iron, plus 9,000 lbs. for weight of slab, making a total load of 110,000 lbs., the beam failed, breaking at the center, and pulling the steel in two at this point. Not a sign of a crack was to be seen throughout the beam at any other place than at the point of failure. This is a very remarkable test. The absolute lack of a crack throughout any portion of the beam, except at the place of failure, is clear evidence that shear was properly provided for.

With this method of reenforcement, the adhesion of the concrete to the horizontal steel member is not essential; in fact, if the latter were placed entirely outside of the concrete, the beam would be very nearly as efficient, as the strain which comes into this lower chord is so largely the summation of the horizontal components of the inclined members.

This principle is utilized in the Kahn patented trussed lintel, drawings and photographs of which are presented herewith, Figs. 6, 7 and 8. In the old system of lintels, an I beam or built up girder was figured on to carry the weight of the superimposed load, and a 12 in. x ¼ in. or other similar plate was riveted to the bottom flanges of the beams to give bearing for the wall above, but the plate was counted upon as rendering little or no service in strengthening the lintel. In the new system this bearing plate not only supports the brick-work directly, but also acts as the bottom flange of a masonry beam, in which the masonry takes up the compression or thrust of a flat arch, while the steel plate takes up the tension. Diagonals, riveted to the base plate, form abutments for a series of arches of stress, which set themselves up within the masonry, and for these the base plate serves as the bottom chord or tie. Each diagonal carries its weight upwards on the principle of the ordinary truss and spreads it on other arches of larger span, each of which has its corresponding abutment in a set of diagonals. Another way of looking at the steel reenforcement for such a masonry beam, is to regard it as a half truss made up of tension members only, the masonry supplying the missing compression members, and the two being firmly

Fig. 9.

united to each other through the cement, which forms a perfect bond between them.

One of the photographs, Fig. 6, shows such a lintel, consisting of a 12 in. x ¼ in. steel plate, to which 1 in. x ¼ in. diagonal members were riveted. The span was 12 ft., height of lintel 11 in., width 13 in. Steel billets weighing 110 to 170 lbs. were loaded on the beam until a total weight of 40,720 lbs. was reached, equal to 3,400 lbs. per linear foot of beam. The deflection was ¼ in. Loading was stopped at this point, as the beam was beginning to be very top heavy, and it was feared might turn over and injure the workmen.

The above systems of concrete reenforcement which have been described are controlled by patents granted and now pending, which are held by the Trussed Concrete Steel Company, Union Trust Building, Detroit, Mich.

Of the 956 locomotives employed on the Siberian Railroad in 1901, 493 burned coal, 282 wood, and 181 petroleum. The petroleum is accessible by the River Volga, near the west end of the railroad. On the Asiatic Midland (from the Caspian eastwards) 314 burn petroleum and three wood. The number of wood-burners in all Russia decreases from year to year. In 1898 they were 24 per cent. of the whole number; in 1901 less than 16 per cent. The number of oil-burners in the latter year was 4,995, and 37 per cent. of the whole number. The total cost of the petroleum used by these 4,995 locomotives was almost exactly the same as the cost of the coal used by 6,290 locomotives. For an equal weight, petroleum cost 70 per cent. more than coal; but on the average the number of pounds of coal consumed per locomotive per mile was only 47 per cent. more than the petroleum consumption of the oil-burners. Per engine-mile petroleum cost nearly 14 per cent. more than coal. Fuel formed 13.6 per cent. of the total working expenses in 1900, against 10 per cent. in 1897 and 1898.

Brunel and the 7-Ft. Gage.

BY HERBERT T. WALKER.

It is probable that but few readers of this journal ever saw or had any experimental knowledge of the Great Western Railway of England when its track was laid to a gage of 7 ft.; and as the writer has had the privilege of traveling on this unique railroad with some opportunities of studying the peculiarities of the "Broad Gage," it is thought that a few remarks on the subject will be of interest to at least the younger generation of American engineers.

This gage was originated by Isambard Kingdom Brunel, who was born in 1806, and appointed engineer-in-chief of the Great Western Railway in 1833. Brunel was one of the greatest civil engineers who ever lived. He was an Englishman born, but of French extraction, and with his great intellect and high education he combined the bull-dog tenacity of the British race with the imaginative and brilliant characteristics of the French people; and having once decided on his plans he carried them through regardless of obstacles, some of his works being either on a gigantic scale in advance of the requirements of his time, or on theoretical bases, their financial success being, with him, a matter of secondary importance. In this regard he was, perhaps, inferior to George Stephenson, who possessed the rare combination of the engineer and the man of business. This may be one reason why the name of the practical and self-educated northern mechanic has a more prominent place in railroad history than that of his artistic, highly initiative, and somewhat reserved contemporary.

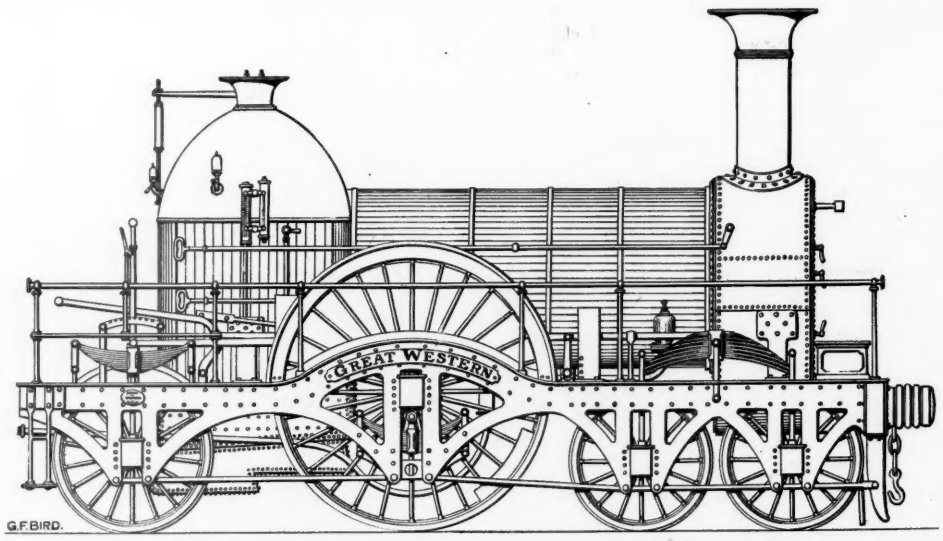


Fig. 1.—Express Engine, Designed by I. K. Brunel, 1846 (Gage 7 ft.).

The writer was acquainted with one of Brunel's draughtsmen. This gentleman described "The Chief" as a kindly man to work for but a strict disciplinarian, and —himself a splendid draughtsman—the slightest error or carelessness on the part of his subordinates was certain to meet with a stern rebuke. His ability to do without sleep was wonderful, and this enabled him to take the entire charge of his work, leaving little or no responsibility with his staff. This system, however, had to be changed in later years, when his health began to fail under the tremendous pressure.

Brunel was a genius. He was the Napoleon of engineers, and was nothing if not original. He designed bridges of such novel construction that everybody prophesied they would collapse. But they did not collapse. They stayed up and are in use to-day, carrying the heaviest trains at the highest speeds. His works are the wonders of old-time engineering, and, aside from their boldness, they possess artistic beauty not always found in modern structures. The Wharncliffe viaduct, near London, carrying the railroad over the river Brent, was named after Lord Wharncliffe—one of the few members of the aristocracy who favored this or any other railroad, and is an example taken almost at random. It is 896 ft. long and about 100 ft. in height, having eight elliptical arches of brick, each arch being supported by a pair of immense brick columns united by massive architraves of stone, so forming single piers from which the arches spring. Standing under the bridge at one end and looking through the openings between the brick piers with their stone architraves, no one can view the vast colonnade stretching away in perspective without being impressed by its beauty and with a feeling of respect for its masterful designer. The Saltash bridge, with its trusses of wrought iron elliptical tubes and suspension chains, is, by some, considered Brunel's masterpiece. It crosses the river Tamar between the counties of Devonshire and Cornwall and is illustrated in Fig. 3.

In 1838 he built a skew bridge with the flattest brick arches then known. It carried the railroad over the Thames at Maidenhead and the elliptical arches had a rise of 24 ft. 3 in. in a span of 128 ft. The newspapers were loud in condemnation of this bridge and foretold its speedy disappearance in the river, declaring that it was only the false work that kept the arches up. When the bridge was finished and before the false work was removed, a storm came up in the night and blew the false work away, leaving the arches intact. It is almost needless to add that the bridge is in use at this moment.

When the time came for Brunel to determine the width of the Great Western track, he saw no reason why he should follow George Stephenson's coal road gage, and having in mind the high speeds—100 miles an hour (!)—and the large wheels he intended to employ, he decided (being governed by the low center of gravity theory of that time) on a gage of 7 ft., calmly replying to the storm of opposition which this innovation aroused that "It has been asserted that 4 ft. 8½ in., the width adopted on the Liverpool & Manchester Railway, is exactly the proper width for all railways, and that to adopt any other dimension is to deviate from a positive rule which experience has proved correct; but such an assertion can be maintained by no reasoning."

In the matter of constructing the track he also departed from the prevailing British practice, holding the opinion that "a continuous bearing under the rail" was preferable to "isolated supports." This was called another of Brunel's innovations, but he silenced his critics (temporarily) by pointing out that many hundreds of miles were laid in this manner in the United States with marked success. It thus appears that the longitudinal system had its origin in this country.

The track as he designed it consisted of stringers or "longitudinals" framed together by cross pieces or "transomes" at every 6 ft. The cross pieces were tenoned into the stringers and fastened by tie rods bolted through the stringers, anchoring the whole firmly together. The

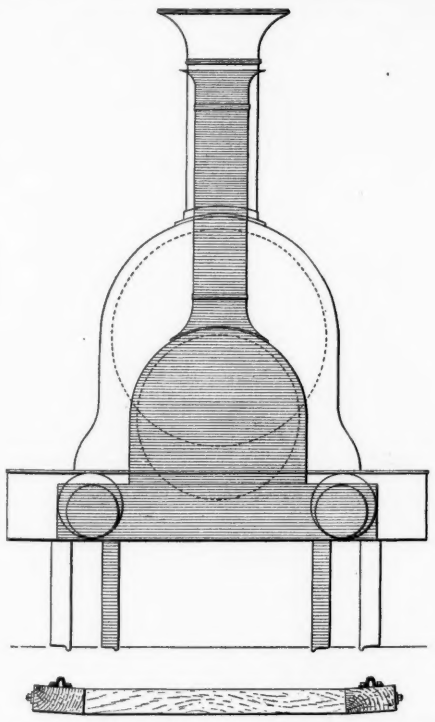


Fig. 2.—Outlines of Broad Gage and Narrow Gage Engines, England, 1846 (84 in. and 56½ in.).

track had then the appearance of a gigantic ladder laid flat on the ground. The rail was called the "bridge rail;" it was hollow and of ∩ section, bolted on to the stringers. The rail joints were even, as were also the joints of the stringers, but they broke joints with each other.

As Brunel was so fully occupied in constructing the railroad he did not trouble to get out plans for the locomotives, but sent orders to various builders, merely specifying the piston velocity, the train speed and the loads to be hauled, and recommending that the engines should have very large and well formed steam passages. By this latter suggestion Brunel showed himself to be in advance

of the old-time British practice, but in this solitary departure from his rule of giving individual attention to every branch of his work he made a serious mistake, for, as a result of the builders having such a free hand, the railroad company became the possessors of the most remarkable collection of locomotives ever seen. Many of them had 8 ft. driving wheels and some of them had wheels of no less than 10 ft. in diameter. Two of them had the boilers and propelling mechanism on separate frames and all had small boilers.

It is needless to describe the trouble these engines gave, but the directors decided, shortly before the opening of the railroad in 1838, to hire a master mechanic to keep them in working order as far as possible until such time as the motive power could be reduced to some degree of uniformity or standardization. Their choice fell on Daniel Gooch, a shrewd, conservative man from the "North country" and a pupil of George Stephenson's.

At that time the standard gage was called the "narrow gage," and a section of the G. W. R. stockholders, chiefly those in the north of England (where the two Stephensons were all powerful) commenced to agitate against the broad gage and its further continuance. The united efforts of Brunel and Gooch were therefore taxed to the utmost to defend the interests of the railroad in behalf of the majority of the stockholders; but the minority were powerful and well organized, and at last Parliament was forced to appoint a "Royal Commission" to inquire whether a provision ought to be made for securing a uniform gage for the railroads of Great Britain. Then commenced in real earnest the "Battle of the Gages," the literature of which would fill a fair-sized library and would take an ordinary man a lifetime to study.

Generally speaking, competition is a good thing. Some standard gage engines were doing excellent work, and in order to show the Gage Commissioners that broad gage engines could do better, Gooch designed a powerful express engine which was completed in 1846. This engine is illustrated in Fig. 1. It was named "Great Western." Its principal dimensions were: Driving wheels, 8 ft. diameter; cylinders, 18 in. diameter x 24 in. stroke; heating surface of the fire-box, 151.05 sq. ft. and of tubes 1,582.16 sq. ft.; total heating surface, 1,733.21 sq. ft.; grate area, 22.64 sq. ft.; weight, about 30 long tons. The engine was originally built with a single pair of leading wheels, but subsequently a second pair, connected by equalizing springs, was added, as shown. Gooch invented many devices in connection with the locomotive engine, but did not patent them. One of them was the suspended link motion, which was used on this engine. Both Gooch and Brunel drove this engine on experimental trips. On one occasion Gooch ran it from London to Swindon (77 miles) with a train of 140 long tons at an average speed of 57 miles an hour, and at another time with a load of 100 long tons he maintained a steady speed of 62 miles an hour. On subsequent trials this engine attained a speed of 78 miles an hour on more than one occasion, but with what loads is not stated. These were good speeds for the year 1846, but they might have been improved on if Gooch had followed up Brunel's suggestions for large steam ports; for it seems that back pressure was the main reason why the "Great Western" and later built engines of its class never exceeded the above speeds.

The "Great Western" ran successfully until 1870, accomplishing a total mileage of 370,687 miles. It was then scrapped.

The annexed diagram (Fig. 2) will illustrate the great difference in size of contemporary broad and standard gage engines. The contrast between the passenger cars was no less striking; and, in fact, in the way of speed and accommodation, as well as in mere increase of dimensions, the Great Western Railway was so far in advance of its contemporaries that credit should be given to Brunel and Gooch, who fought so hard and for so many years to show that the standard gage was not the best one for the development of steam railroads.

The broad and standard gage cars were 9 ft. and 7 ft. wide respectively. The standard gage "first class" coach was so niggardly in head room that an incautious entering passenger would strike his hat against the door lintel, and as the cars ran on four wheels the riding was hard and rough, the pounding of the wheels at the suspended rail joints being unpleasantly noticeable. The third class cars were called "open trucks," for they were without roofs, and the unfortunate passengers were blinded by dust and cinders, choked in tunnels, and some even died from exposure in cold or wet weather, as umbrellas could not be held up in the rushing wind. *Punch* said some good things about these cars, and one wag called them "pig-boxes." It is hard to understand why the public submitted to these outrageous conveyances.

On the other hand, the Great Western Railway third class cars had roofs and sides, but no glass windows, the openings being covered with venetian blinds and sliding doors. They were not very comfortable but far superior to the "pig-boxes." A little later they were built with glass windows and the bodies were made of sheet iron No. 11 wire gage and framed together with angle irons. These cars were noisy, but a protection to passengers, as they are said to have withstood the shocks of collisions. The first class coaches had six wheels and were really luxurious, being fitted with tables and sofas "and all the appliances for the agreeable occupation of time." Brunel put on some "saloon" carriages for opulent patrons; an extra fee was charged for them and they were thus the forerunners of our parlor cars.

To help popularize the railroad, Gooch introduced, in 1844, a system of express trains, at extra fares, and they were also much liked by the aristocratic passengers—of which there were many. Gooch claimed to be the "father of express trains," and, as far as the writer knows, he is entitled to the honor.

The traveling public were in favor of the broad gage, for it was a princely railroad, turned up to the pitch of "Brunel the Great," who never did anything by halves, and whose express trains were running at an average speed of 44 miles an hour, whilst the expresses on the London & Birmingham Railway averaged but 23.6 miles an hour. A Great Western director seemed to have a patrician air which distinguished him from the directors of other railroads, and the officers and employees themselves were proud of their connection with this unique line. The very enginemen were impressive in their suits of white canvas—put on clean every morning for "crack" trains. They were generally stoutly built fellows, with stern faces and bushy eyebrows. In winter they wore full beards for the protection of the chest, for it was no joke to bowl along at a mile a minute in the coldest weather with absolutely no shelter but the boiler head. In very bad storms some engine-drivers wore a pair of goggles, after the manner of the "chauffeur" of to-day. These glasses were not recognized by the motive power department, but were winked at for the sake of humanity. The "guard," or conductor, was an important person, with courtly manners and semi-military uniform—for he was brought much in contact with the rich and great and knew well how to handle them. The Great Western Railway was the rich man's railroad, entering London, as it did, at the "west end," or aristocratic quarter of the town, and touching, as it did, many fashionable watering places and resorts in the west of England, to say nothing of the districts in which were located the country homes of England's proudest nobility, who, by the way, opposed the passage of the railroad through their estates by every means in their power, though on its completion they were only too glad to ride on "The Western," as they patronizingly called it.

In its early days this railroad was not a financial success, one reason being the preponderance of passenger business over freight, as there were but few manufacturing towns in the west of England. Another reason was that the track was expensive to maintain, the ∩ rail being deficient in vertical stiffness, and, on the passage of a train, it sprang and crushed into the longitudinal sills. As the latter were continuous, it was difficult to provide means for drainage, hence water settled under them. As the sills could not be tamped uniformly for the entire length, there were occasional spans without firm support. This caused a rolling motion to the cars. Nevertheless there was less noise and riding was far more agreeable than on the standard gage.

When the third rail was laid down to accommodate standard gage cars, the expense of up keep was nearly doubled, and at last it became evident that the broad gage would have to go; and the final conversion of the Great Western Railway system to standard gage was effected on May 23, 1892.

The broad gage was crowded out mainly because a uniform gage for the interchange of traffic was an absolute necessity; but whether the standard gage is the best gage may be fairly doubted, for even George Stephenson admitted (when he was not in the Committee Room) that 5 ft. 2 in. would have been a better gage than 4 ft. 8½ in.; and it is a noteworthy fact that all the engineers (except the two Stephensons) who were examined by the Gage Commissioners gave their opinion that the standard gage was too narrow for the proper development of the locomotive, and that a gage of from 5 to 6 ft. would have been preferable.

If the reader is sufficiently interested in the matters touched on in the foregoing notes, he will find Sekon's "History of the Great Western Railway," and G. F. Bird's "Broad Gage Locomotives of the Great Western Railway," both published in London, of much value. Mr. Bird has made a special study of his subject, and has, at the writer's request, kindly furnished him with the drawing of the engine "Great Western."

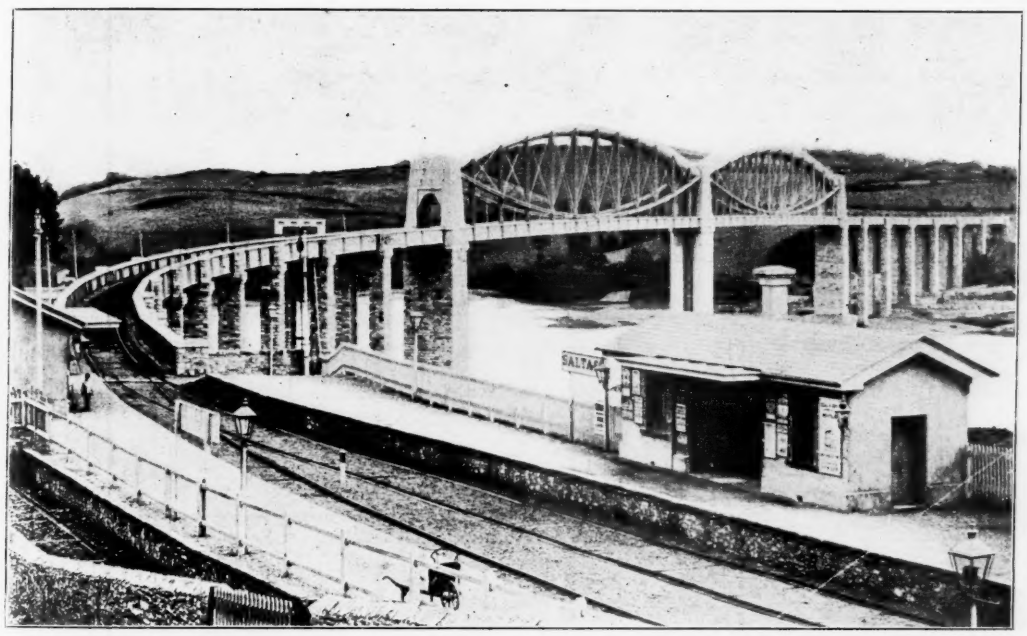


Fig. 3.—Bridge at Saltash, on the Great Western Railway of England.

Changes on the Paris Metropolitan.

The following report to the Prefect of Paris by the Paris Metropolitan Co., is translated freely from a recent issue of the *Journal des Transports*. After the catastrophe last August, the Prefect ordered the company to make certain specific and certain general changes to insure greater safety, and the report deals with the progress which has been made in carrying out these orders.

The line is divided into sections composed of five stations. Each section is under the control of an inspector who is always on duty. If an accident or break-down occurs the inspector immediately goes to the spot to direct the work and then accompanies the train to the end of his section, where he hands it over to the next inspector, who passes it on in the same way so that the train travels under special inspection until it reaches the repair shop. This is only a temporary measure, as it interferes with the train schedule. Inspectors only take charge of such trains as have met with accidents likely to cause fire or to lead to derailment. Under pain of immediate dismissal every engineer has orders on discovering a short circuit in the motor or connections to instantly remove the collector from the third rail and to disconnect the car affected.

The lights and signs indicating the exits have been increased. The best plan appears to be to use a special type of "safety lamp" so that the passengers can find an exit by going to one of these new lamps, whether the other lamps are lighted or not. One lamp has been placed above the stairway on each platform with a third in the waiting room near the exit staircase. In the more complex stations of l'Etoile, or la Nation, the lamps are placed in such a way that a passenger may get from the platform to the street by simply following a series of lamps. The lamps are arranged so that in making one's way out no lamps are visible from the side. This avoids possible confusion and loss of way. These lamps are supplemented on the platforms and in the corridors by arrows marked EXIT.

These safety lamps are to be lighted from a circuit completely independent of the present lighting circuit. In the original design it was thought that security in lighting would be obtained by using two circuits. The four wires of these circuits were attached to the roof, two lighting the right and two the left hand side of the tunnel, so that an accident might extinguish the lights on one side without interfering with those on the other. Unfortunately in the recent catastrophe the train took fire when exactly underneath the footbridge crossing the tracks where the four wires branched out into the right and left hand circuits for the Ménilmontant station. The destruction of the cable extinguished the lights on both sides. Although the recurrence of a similar accident is extremely remote it is still necessary to have a reserve installation perfectly protected from fire and ready to replace the regular lighting installation in case of accident.

Fire plugs are being installed at all stations to meet the approval of the Fire Department and of the Prefecture of the Seine. The seats on the platforms are to be replaced by fixed benches. The weighing and automatic ticket selling machines are to be fitted in with the seats so that there are no projections beyond the line of the benches.

The barriers are to be rearranged so as not to offer any obstruction to exit, even when the station is emptied hurriedly using the entrance stairway as an exit. The company calls attention to the fact that a railroad like any other business must not be designed alone to meet

accidents, but to operate satisfactorily under normal conditions.

All electric apparatus put in the car is to be insulated from the wood by a non-combustible substance. The walls of the motorman's compartment are covered with asbestos. The floor cannot be made of steel plate on account of the danger of setting up an electric arc, and is therefore of wood, fireproofed on the top and sheathed with asbestos below. The plate of the controller is made of fireproofed wood covered with asbestos inside and out.

The method of coupling two motor cars in a train is changed. Under the old system the current was taken up by the front car, and the full current of 600 amperes was carried under the train to the second motor car. This had certain elements of risk which are avoided in the new multiple-unit system. In this system each motor car picks up its own current, and the only current carried along the train is the insignificant amount governing the controllers.

To enable the motorman to cut off current from the car an apparatus is provided to enable the collector to be instantly and safely taken off the conductor rail. This apparatus can be operated from the cab without the necessity of getting down, and in case of failure the train crew are provided with rubber gloves.

New 50-Ton Gondola Cars for the Burlington.

The Chicago, Burlington & Quincy is receiving the first of an order of 1,000 100,000 lbs. capacity gondola cars built by the Standard Steel Car Company, Pittsburg, under patent owned by the Caswell Car Company, Chicago. The underframes are made of structural and pressed steel shapes and the sides and ends of the cars are wood planks bolted to the steel stakes, posts, braces and counter braces. The cars will be used chiefly for hauling coal. When the doors are closed the floor is level and the cars can be used in the same manner as ordinary gondola cars, there being no obstructions or irregularities in the floor to interfere with the use of shovels. The road is encouraging its customers, however, to modify their coal chutes, etc., so that the drop bottom doors can be used in unloading. The cars have the following general dimensions:

Length over end castings	41 ft. 2¼ in.
Inside length	40 ft.
Width over side stakes	10 ft. 1½ in.
Inside width	9 ft. 3 in.
Height to top of brake wheel	8 ft. 9 in.
Inside height	4 ft. 3⅞ in.
Height of floor above rail	4 ft. ½ in.
Height of center of drawbar above rail	2 ft. 10½ in.
Center to center of trucks	29 ft. 2¼ in.

The side sills are 8 in. steel channels placed above the line of the floor with the flanges turned inward. The sills are riveted through the back to the stakes, which are in turn riveted to the transverse diaphragms by means of connection angles. The cross beam and side sill connection angles are 3½ in. x 3 in. x 5/16 in. and the bolster and side sill angles are 6 in. x 3½ in. x ⅜ in. at the corners. The backs of the side sills are riveted to the corner posts. The corner posts are also riveted to a short channel section, the upper flange of which is riveted to the lower flange of the sill. The end sills are connected to the side sills through the flange of the corner post which is riveted to the short channel, as mentioned above. The corner is also additionally strengthened by the push pole corner iron. The side sills are backed up by 4 in. x 4½ in. timbers held in place by bolts. The upper inside edges of these timbers are chamfered and the bottom side of the timbers serves as a stop for the drop bottom doors, as shown on the cross section of the car.

The center sills are two 15 in. channels 33 ft. 1 in. long spaced 13⅝ in. apart with flanges turned outwardly. The center portion of the sills between the cross beams for a distance of 18 ft. 10 in. is reenforced by 4 in. x 4 in. x 7/16 in. angles riveted to the lower edge of the back of each channel. The top cover plate is 24 ft. long and extends nearly to the bolsters. This construction gives the most metal at the center, at which point the maximum bending moment occurs. A pressed steel stiffener of box section is riveted inside the sill beneath the second and fourth cross beams respectively. The center sill is continuous from draft sill to draft sill and the bolsters and cross beams are built up around it.

The end sills are pressed steel channels and are 8 9/16 in. deep at the ends and 13 13/16 in. deep at the center. The total length of each sill is 9 ft. 6½ in. and the flanges are 4 in. wide. The end sill flanges fit around the end of the draft sill and a rigid connection is made by means of vertical connecting angles and gusset plates. A slot 27¾ in. long and 2½ in. wide is cut in each side of the sill and there are corresponding slots in all bolsters and cross beams for the shaft of the door opening mechanism.

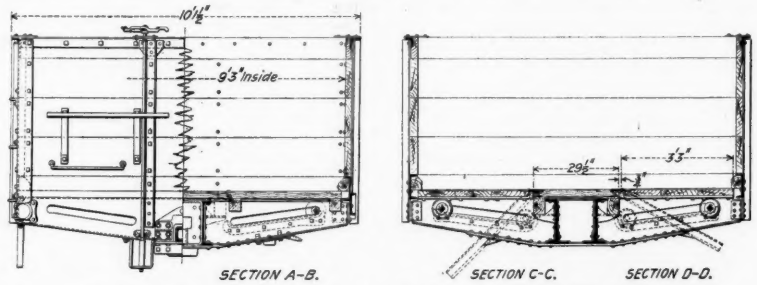
The draft sills are each built up of two pressed steel Z sections ⅜ in. thick with flanges 3¾ in. wide. The height is 16 in. except at the outer edge, where the sill is curved up to 12⅞ in. The total length is 4 ft. 7 in. The sill is riveted to the end sill, as previously noted, and is also held together by top and bottom tie plates, 11¼ in. x 9 in. x ⅜ in. and 20⅛ in. x 9 in. x ⅜ in. respectively. A filler 12 in. x 2½ in. x ⅝ in. is used between the lower flanges of the draft and center sills.

The body bolsters consist of pressed steel web fillers placed back to back and held together by top and bottom tie plates. Between the center sills are pressed steel stiffeners, the same rivets passing through the web filler flanges, stiffener flanges and center sill channels. The top tie plate is 9 ft. 1 in. x 16 in. x ⅝ in. The bottom tie plate is bent to conform to the slope of the web filler and is 14 in. wide at the center and 7½ in. wide at the ends. The bolster web filler is made of 5/16 in. material and is 15 in. deep at the center and 8 in. deep at the ends. The width of the flanges is 3¾ in. The diaphragm of the web filler is offset ⅜ in. at the outer end and the leg of a T angle is riveted in the space thus formed, so as to provide stiff flanges for riveting to the stakes.

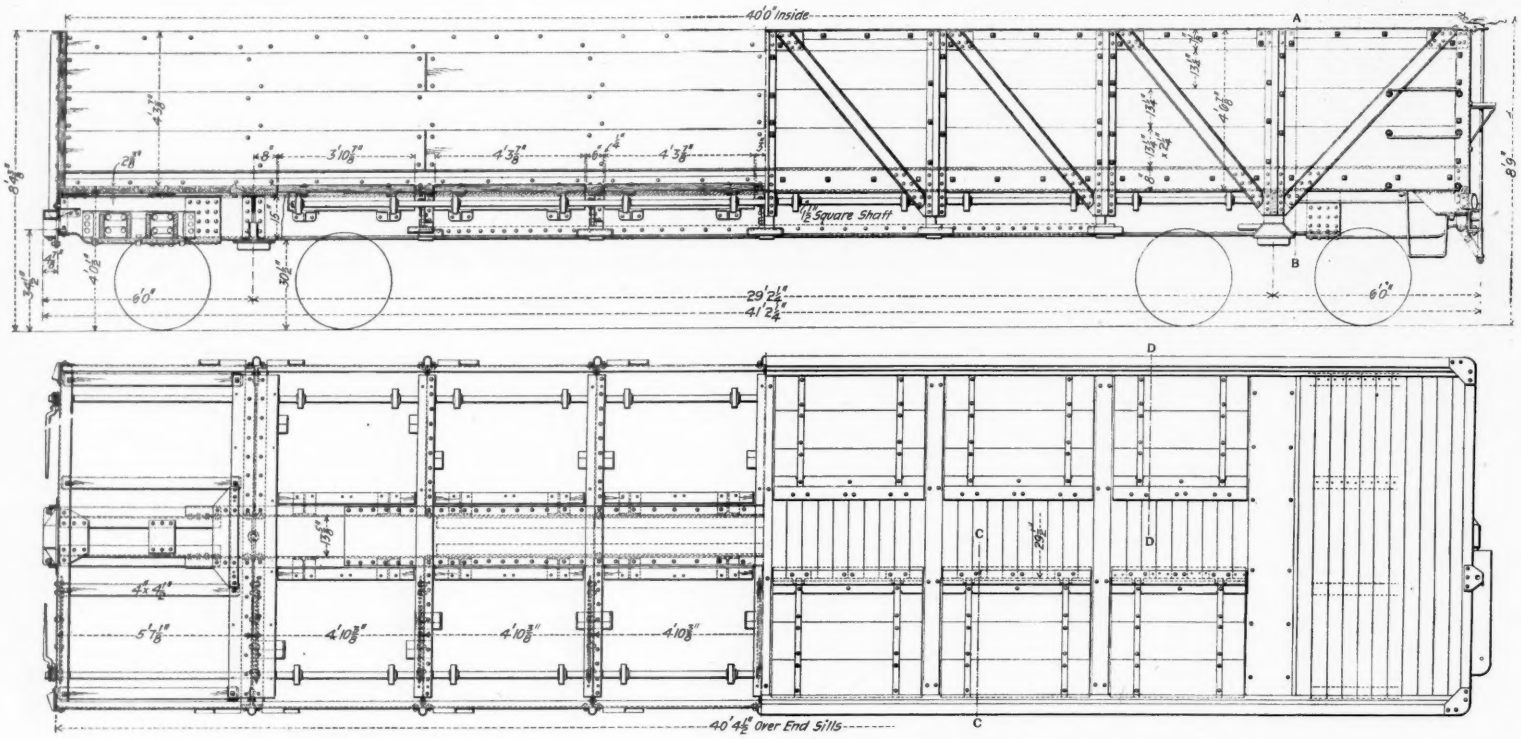
The cross beams are similar in general design to the body bolsters except that a single web filler is used on each side. The web fillers are made of ¼ in. material and are 15¼ in. deep at the center and 8¼ in. deep at the ends. The flanges are 3 in. wide. The top tie plate is 9 ft. 1 in. x 6 in. x ⅜ in. and extends clear across. The bottom tie plate is 5 in. wide and of 7/16 in. material, but does not extend all the way across, it being only 6 ft. 4 in. long when straight. A 3½ in. x 3 in. angle is riveted to the end of the web filler, which serves as a connecting angle for the stake and cross bearer.

The side and end constriction of the car body is very strong. The stakes are semi-circular in section with flanges, through which pass bolts for holding the 2¼ in. thick wooden sides. Each panel between the stakes is braced by a 5 in. channel and each end panel is similarly counterbraced. A 3 in. x 3½ in. angle forms the upper rail of the side. The rail, braces and stakes are joined together by gusset plates which, together with the rigid connections between the stakes and cross beams, gives a strong trussed side construction. The end posts are 3 in. x 3 in. angles bolted to the wooden ends and riveted to the rail and end sill. The corner posts are 5 in. x 5 in. pressed steel angles. The wooden floor of the car is 2⅜ in. thick and between the body bolsters and end sills is supported on four 4½ in. x 4 in. nailing strips. The portion of the floor over the center sill and between the body bolsters consists of short transverse strips held down by metal straps bolted through 4 in. x 6 in. timbers supported from the center sill by brackets. The hinges of the drop doors are also fastened to these timbers as shown.

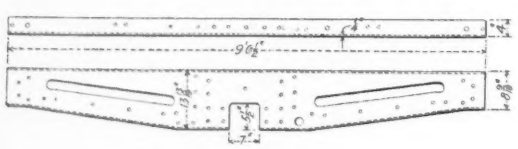
On each side of the car between the body bolsters is a series of six doors. All doors on one side are operated simultaneously by the Caswell opening mechanism, which is shown herewith in detail. Beneath each slot in the bolsters and cross beams is bolted a rack which engages with a pinion fastened to the 1½ in. square shaft which



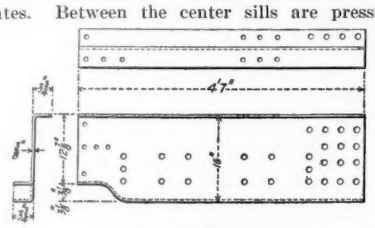
Cross Section and End Elevation of Burlington 100,000-lb. Gondola.



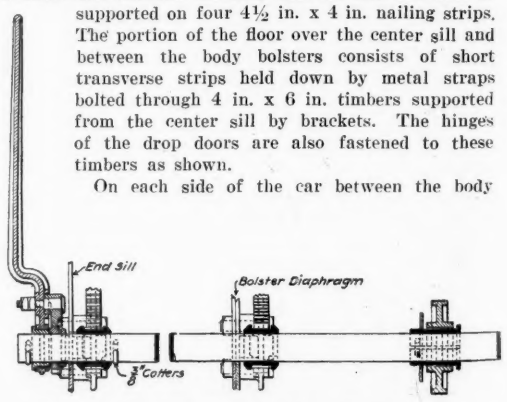
Plan and Elevation of 100,000-lbs. Capacity Steel Frame Gondola with Caswell Drop Doors—C., B. & Q.



Detail of End Sill.



Detail of Draft Sill.



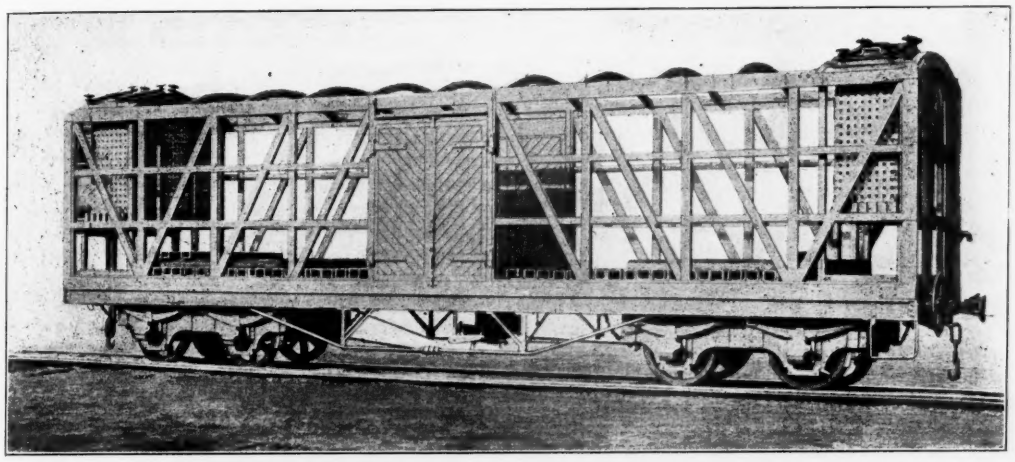
Detail of Caswell Door Opening Mechanism.

extends the length of the car. The shaft passes through the above mentioned slots. When the doors are closed the rollers on the shaft beneath each door press against the bottom of the door and hold it shut. By means of the levers at the end of the car the shaft is turned towards the center sill and the racks and pinions cause the shaft and rollers to move obliquely downward. The weight of the load opens the doors, the maximum opening being regulated by stops riveted to the cross beams and bolsters. The doors are closed by turning the shaft in the opposite direction.

The cars are fitted with Commonwealth truck bolsters and Westinghouse and Miner draft rigging.

Refrigerator Cars for South Africa.

The Cape Government Railway has recently ordered from W. R. Renshaw & Co., Limited, Stoke-on-Trent, England, a number of refrigerator cars, the framing for which is shown in the accompanying engraving. These cars will be used in the frozen meat traffic from Cape Town to Johannesburg and the Transvaal and Orange River Colonies. They have been built to the latest standards of the Cape Government Railways and have a capacity of 30 tons. The underframe is built up of channels and is trussed under each side sill with 1½-in. truss rods. The car is mounted on Fox pressed steel trucks of the English pattern with semi-elliptic pedestal springs.



Framing of Refrigerator Car for South Africa.

33-in. wheels and 4-ft., 9-in. truck wheel base. The bolsters are 24 ft. apart, center to center, and the inside dimensions of the body are, length 36 ft., width 6 ft. 6 in., height 7 ft. 6 in. Vacuum and hand brakes are both applied.

The insulation in these cars has been carefully provided for. Sides, floor and roof are all 6 in. thick, being made up of two layers of tongued and grooved boards with insulating paper between, on the outside of the frames, and two layers of boarding inside the frame, with the air spaces thus formed filled with cork. There is an ice box at each end of the car to hold two tons of ice. These boxes are so placed, together with deflecting diaphragms, that the cold air is circulated in all parts of the car. The water drip is carried off through beveled drains in the floor, lined with zinc, and leading to drip pans under the floor. The doors are of the double swing type heavily padded with canvas filled with hair. The cars are iced through the roof and in many respects follow closely American practice. We are indebted to *The Engineer*, London, for the engraving.

The Telegraphone.

The National Telegraphone Company, of Rochester, N. Y., now has its apparatus in use on the Atchison, Topeka & Santa Fe, the Buffalo, Rochester & Pittsburg, the Chicago, Rock Island & Pacific, the Denver & Rio Grande, the Kansas City Southern, the Maine Central, the New York Central & Hudson River, and the Wheeling & Lake Erie. The instruments put in by this company, as most of our readers already know, are telephones arranged to be carried on a car or locomotive and attached to the telegraph wire at any point along the line, thus affording means of prompt communication with the superintendent's office in case of a breakdown or other emergency at a point remote from a station. Communication is made with a telegraph wire by means of a pole, like a fish pole, and the other end of the circuit through the telephone is connected with the ground; and a switch is provided so that from the car or engine a current of either polarity can be sent to the line. By this means communication can be made at any time in either direction from the point where the telegraphone is connected. At the same time, the ground connection is not good enough to interfere with the Morse telegraph. Where necessary, bridges, with condensers, are run around the telegraph instruments at way stations; and telephonic communication can be carried on simultaneously with telegraph work. Telephone messages have been sent over distances of 125 miles and more. As a rule the line must be favorably situated to carry the messages so far as this, though in one case this distance has been accomplished on a wire that is over 30 years old.

On the New York Central and the B., R. & P. these instruments have now been in use more than a year; and many wrecking cars, inspecting engines, cabooses, and other vehicles, are equipped. The lines which have telephones at the division terminals and important stations, for the purpose of receiving messages from emergency points, are on the New York Central: the R., W. & O. division, 449 miles; the West Shore division, Weehawken to Ravenna, 150 miles, and the Pennsylvania division, 120 miles; on the B., R. & P. the entire line, except from Buffalo to Ashford Junction. On this road there is one passenger train that carries a telegraphone.

On the Chicago, Rock Island & Pacific, the lines are equipped all the way from Topeka, Kan., to Santa Rosa, N. Mex., 900 miles, and from Witchita to Herrington, 228 miles. On this road a number of local freight trains and work trains carry telegraphones. On the Denver & Rio Grande all freight trains on the mountain division are equipped. Between Salida and Minter, 96 miles, 12 cabooses are equipped. On this and other roads where telegraph stations are long distances apart, "track-sets" are fixed at numerous sidings and other places where there is no agent. A "track-set" is substantially the same as a car set, except that the telegraph wire is run into the building.

On the Maine Central 800 miles of line has been equipped and conversation has been carried on between Portland and Bangor, 136 miles.

To call a station from a car, or from a "track-set" telephone office, a magneto is used. No special apparatus is needed at the office as the magneto, by means of a segment in the periphery of the wheel, disturbs the telegraph circuit at each revolution. By turning the crank at moderate speed, therefore, all of the relays on the line are made to give out a rapid succession of dots, making an unmistakable call, which is quickly noticed by the telegraph operator. The telephones at the stations can, of course, be used for every day communication, one to another.

Foreign Railroad Notes.

Locomotive enginemen and firemen in Switzerland are employed first "on probation," for periods heretofore varying on different lines. The State Railroad authorities have now decided that the probation shall, as a rule, not last longer than two years, when the men approved receive definite appointments, which mean a permanent position, except serious misconduct forfeits it. The men desired the shortening of the probation to one year.

There has been a very low rate for shipments of fruit and vegetables from Italy to the northern countries of Europe, but it was granted only on the condition that the shipper contracted to ship at least 5,000 carloads per year—a condition likely to limit the business to a very few Italian firms, and to reduce the prices obtained by the producers. It has now been ordered that from certain stations in Southern Italy and Sicily this low rate shall be granted for shipments of single carloads.

In Austria a man driving a skittish horse along a railroad called to an engineman to cease whistling and stop his train, which the engineman neglected to do. The man, having been hurt by the action of his frightened horse, sued the State Railroad for damages, and recovered in the first instance and also on appeal; but the Supreme Court reversed this decision, and found that a train is not bound to stop whenever a horse in sight pricks up its ears.

The Siberian and Chinese Eastern railroads were opened for the transportation of the mails of all countries in the International Postal Union Oct. 1 last. Heretofore they carried only the Russian mails to the Pacific. France, Germany and Belgium immediately directed their mails by that route to all places which can be reached quicker by it than by existing routes. For German mails these places are declared to be Japan, Corea and China as far south as the Yang-tse-Kiang. Canton, therefore, seems to be reached more quickly by the Suez Canal than by the railroad. Mails are not carried on the International Sleeping Car Co.'s special trains over the Siberian railroad, and by the ordinary trains the time is 17 days from Moscow to Dalni. The Russian steamers from Dalni to Japan and to Chinese ports sail only once or twice a week. The time of the mail on the road thus varies. From Berlin to Pekin it is 20 to 22 days; to Shanghai, 22 to 28; to Nagasaki, Japan, 23 to 29. By steamer and the Suez Canal the usual time is: Peking, 40 days; Shanghai, 33; Nagasaki, 36.

Creeping Rails.*

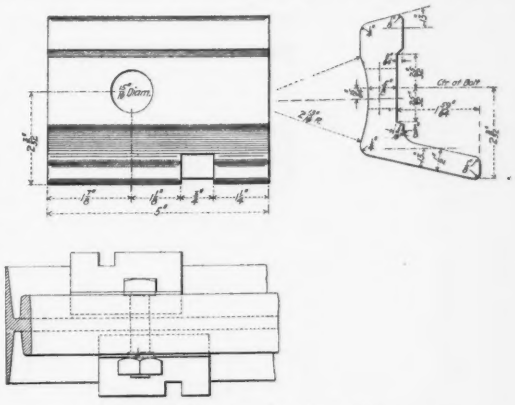
BY F. J. ALLEN.

The subject of creeping rails is one which every person connected with maintenance of way on railroads has had to contend with in some form, experiencing more or less trouble. Rails will creep, and up to the present time it has been beyond the power of human genius to effectually prevent it. It is also true that to a certain extent we have overcome it, or rather we have guarded against it in a manner that reduces its bad effects to a minimum. The subject of creeping rails may properly be divided under three heads, viz., cause, effect and remedy.

The principal cause of rails creeping on double track railroads is the fact that the traffic on a given track is all in one direction, and the heavier and faster the trains the more the rails will creep. This is especially true on heavy down grades where all trains maintain high speed. The pilot wheels of an engine are always running up hill, regardless of the gradient of the track, and it is this that pushes the rails ahead, or in other words, makes the rails creep. Other and minor causes tend to produce the same effect in a smaller degree. On single track railroads the rails do not creep entirely in one direction, as on double tracks.

The effects of creeping are varied. Where there are crossovers between parallel tracks, the switches and frogs run ahead in the direction of the traffic, necessitating moving tracks back in order to preserve the proper alinement of main track. Where railroads cross at grade, especially at points where there are several parallel tracks in each direction, the effects of creeping are quite serious. I have in mind a place where there are eight tracks in one direction and six in the other, making 48 crossings, and it is only a short time after new crossings are put in before they are all out of line in both directions. At crossings on double tracks where trains run at high speed, it is absolutely necessary to keep all tracks in proper alinement. To do this it is necessary to prevent the rails from creeping, or resort to the constant practice of cutting rails or using short pieces and moving crossings back to their proper positions. Under certain conditions the rails on one side will creep more than on the other, and this has a tendency to move the ties out of place so that they are not at right angles to the rails. This causes a tightening of the gage of the track and produces an irregular line, or in common phrase, makes kinks; and these are readily perceptible to the eye. Rails creep more in warm than in cold weather. This is accounted for by expansion of the rails which forms tight joints, making an almost solid rail for long distances.

The best remedy which has been found is to lay the rails broken joints, with heavy angle bars slotted at each end for spikes; and to place an anchor on the middle of each rail, opposite the joints, where 30 ft. rails are used. This gives an anchorage every 15 ft. and greatly reduces the creeping. The anchors can also be applied to the middle of rails with laid "square joints," by placing anchors directly opposite each other so they can be spiked to the same tie. I prefer broken joints. For the anchor



Anchor Splice for Creeping Rails.

we use a section of our standard angle bar 5 in. long, with a hole drilled through it and slots cut out for the spikes. We drill a hole through the rail and these 5 in. sections of angle bars are put on the rail the same as a regular angle bar and are also spiked in the slots to the tie.

Our standard angle bars are 38 in. long, making a "three tie joint." The angle bars are slotted so as to make an anchor on the two outer ties, near the ends of the angle bars. About opposite one end of the angle bar and on the same tie which is anchored by the slot in the angle bar, we place the 5 in. anchor splice and spike it to the same tie. This device has proved in actual practice during the past 10 years to greatly reduce the creeping of rails, and it tends to hold the rails in their proper position. It has been so successful that we use it in all cases on our double tracks.

*Read at the Roadmasters' and Maintenance of Way Convention at Kansas City, October 14, by F. J. Allen, of the Chicago, Burlington & Quincy.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Rarely has there been a statement of railroad earnings more remarkable than that of the Pennsylvania Railroad for the eight months ending with August last. On the lines east of Pittsburg and Erie the increase this year was no less than $8,893,600. Truly, one might think, this proves that the Pennsylvania stockholders are growing rich fast, for this increase in earnings is 3½ per cent. on the company's capital stock—all gained in two-thirds of a single year, following a series of years of great prosperity. But when we find that the working expenses have increased meanwhile to such an extent that nearly 99. per cent. of this immense increase in earnings has been absorbed by them, leaving in net earnings a gain of only $90,500, which is less than 4 cents per $100 of stock, our wonder is no less, but is differently directed.

From 1894 to 1902 the freight traffic of the United States—the number of tons carried one mile—increased from 80,335 millions to 157,289 millions, which is 96 per cent. The movement in 1894 was the low water mark after the financial disturbance of the previous year; but even this had never been equaled before 1891. That this traffic should have nearly doubled within eight years seems almost miraculous. In an entirely new country previously almost devoid of means of transportation such a rate of growth is easy to understand; but in this country, where the increase in railroad mileage was comparatively small at the time, where already the population was efficient in production to an extent unknown elsewhere, it is truly wonderful. It could not have been possible except for the development in the same time of the iron industry on an enormous scale, giving hauls—often very long ones—of ore, flux, coal and products in vast quantities. The production of pig iron, which may be taken as a measure of the whole iron industry, increased 168 per cent. from 1894 to 1902. That growth at such a rate cannot continue indefinitely is evident after a little reflection. A freight movement at the rate of a ton carried 2,000 miles for each man, woman and child in the nation cannot be doubled in the next eight years. No such marvelous expansion of the iron industry as that since 1894 is again possible in so short a time; and no market for its products could be found if it were possible. Judging by the activity of traffic and the increase in railroad earnings, the growth of traffic continued about at its recent rate in the year following that last reported, however.

The Growth of Passenger Traffic.

We have heretofore, in studying the traffic statistics of the country, noticed that for some time after the present period of prosperity began, while freight traffic was growing at a marvelous rate, travel increased much more slowly, and we have shown that this was true in other periods as well; while for several years past, the multiplication of trolley lines in the country has diverted a very considerable amount of suburban and short distance travel, and so to some extent offset the increase in other railroad travel. The statistics of the last three years, however, ending with June, 1902, show that passenger traffic on the steam railroads has at last begun to grow as if to make up for lost time.

It is worth while to follow the growth of this traffic, which since 1889 shows two periods of growth, with an intervening decline and period of stagnation. For five years, the railroad travel, in millions of passenger miles, was:

1890.	1891.	1892.	1893.	1894.
11,848	12,844	13,363	14,229	14,289

Here we have an increase of 20 per cent. in the three years to June 30, 1893, which is almost the exact date of the panic. This was the normal growth of the time; for the effect of the Chicago World's Fair was insignificant up to this date; to it, however, it is due that there was no decrease in travel the following year, which was the first of great business prostration, as shown by the fearful falling-off of 14 per cent. in freight traffic from 1893 to 1894.

For the next four years the millions of passenger miles were:

1895.	1896.	1897.	1898.
12,188	13,049	12,257	13,380

Thus travel decreased 14 per cent. from 1894 to 1895, just as freight traffic had done a year earlier, and in 1898 it was still 6½ per cent. less than in 1893 or 1894.

For the following four years the figures are:

1899.	1900.	1901.	1902.
14,591	16,039	17,354	19,690

In 1899 the figures of 1893 were again reached, population meanwhile having increased about 11 per cent., so that travel was still relatively light—perhaps not more so, however, than the diversion to electric railroads will account for. But the growth thus begun has kept on at a very fast rate—9 per cent. from 1898 to 1899, 10 per cent. in 1900, 8 per cent. in 1901, and finally 13 per cent. in 1902. Here we have a growth since 1897 of 60½ per cent. in five years, during which the increase in population, considering the heavy immigration, may possibly have been 11 or 12 per cent. From 1895 to 1898 passenger traffic increased only 10 per cent., while freight traffic increased 34 per cent.; but in the last five years passenger traffic has kept pace, very nearly, with freight, 60½ per cent. against 65½, and both have grown as if on a wager. Since 1899 the passenger business has grown the faster of the two—35 per cent. against 27 per cent.

The relatively slow growth of travel in the first few years of returning prosperity is due doubtless to the fact that a very large part of travel is a luxury, one of the first things to be dispensed with when incomes fall off; while, when incomes begin to recover, other postponed expenditures are apt to be made before much money is spent in travel not strictly necessary.

The New Haven Railroad Problem.

The coming of Mr. C. S. Mellen to the presidency of the New York, New Haven & Hartford railroad company is an event in railroad administration of somewhat uncommon import. This is not merely because of the personality of the new president and his long experience in railroad affairs west and east, but because of the unique character of the property which he is to manage, its peculiar local situation and the exceptional nature of the questions which now arise in its administration and development.

The New Haven system, now, in earning power and intrinsic value of the plant, high among the foremost railroad systems of the country, has had a singular history. In its earlier years, but reaching down to a period later than the merger with the Hartford and Springfield road, its management was ultra-conservative, not to say old fogy. Men not yet gray-headed will recall when the words, "No freight received after 4 p. m.," was big-lettered on its freight houses, and when a director opposed a new passenger train because "People would be crowding it in less than a week." The freight business, indeed, was systematically discouraged in favor of the large passenger traffic which could "handle itself." To such an antiquated regime succeeded the radical administration of President Clark. But Mr. Clark, while he made important beginnings in the freight traffic and drew long basic lines for freight traffic to come, concerned himself chiefly with questions of expansion and new construction, leaving matters of operation to subordinates; and President Hall, his successor, was by antecedents and training a lawyer, not a railroad man. Now, for the first time in its history, the company is to have a head who is in the large sense of the term an operator—familiar from training begun in early life with every phase of railroad transportation and abreast of its newest conditions.

He will find, as stated, a unique railroad property. In the world, apart from State control, there probably exists no railroad system whose territorial monopoly is more complete in a region of dense population than that of the New Haven company in Connecticut, Rhode Island and southeastern Massachusetts. "Fortified by land and covered by a navy on the sea" is a phrase that has been used not inaptly to describe the New Haven's system in southern New England. This situation has simplified some of the problems of the company at non-competitive points, but it has deepened them at competitive points. It has strengthened the anti-monopoly cry in Massachusetts and, even more notably, in Connecticut, and wrested from the corporation important concessions, especially in fares. It was, in part, responsible for the failure of the company to secure in the last Connecticut legislature the proposed modification of the car detention law. And, joined with it, there is in the latter State a pretty intense jealousy in favor of the localized control exercised through the charter provision that a majority of the directors must be Connecticut residents. President Mellen's contacts and collisions with public temper in the three old New England States will probably be among his most noteworthy experiences following those in the newer and broader west.

But in more specific matters of transportation the new president will find work to be done. There is the new per diem car detention rule which during the year ending June 30, 1903, caused an increase of $457,408 in operating expenses and alleviation of which is made more difficult by Connecticut's law. The company has paid thus far comparatively scant attention to a growing demand for local and suburban trains, especially in the high tide of summer travel. In the matter of time and time-tables the operation of the system during the year past has been unsatisfactory. Although it has been stated officially that the road has reached the end of costly improvements, there remains some expensive work yet to be done in Connecticut and more in Massachusetts; and the experience of the company has shown that the demand for improvements makes the meat it feeds on and what one municipality gets to-day another will demand to-morrow. Incidentally may be named the development of the export trade at Boston already begun by President Hall. To such propositions the company's first presidential operator will have to bring his highest skill, and the outcome will not be the less suggestive when worked out by a president, coming from a railroad system whose operating expenses are only 52 per cent. of its gross earnings, and applied to a system whose operation last year cost 73.91 per cent.

But it is in respect to the policy of his company in electric roads that President Mellen will be up against some of the most serious as well as interesting problems of his corporation. The New Haven company, taking the latest returns as a basis of computation, operates about 182 miles of electric railroad, single track, in nine widely separated localities and under quite divergent conditions. They include old trolleys bought up to ward off electric rivalry and still operated as trolleys; former steam lines electrified both by trolley and third rail; and, in one case, an extensive trolley system—the Worcester and Connecticut Eastern—created both by new construction and by purchase to thwart threatened competition by the novel expedient of self-parallelism of the company's steam road. The annual receipts of all these electric lines amounted last year to $772,666, with operating expenses of $425,661—not including, in most cases, maintenance of roadway or stations, or interest or depreciation on first cost—while for the year just expired the figures have probably risen considerably. No steam railroad corporation in the country compares with the New Haven in either the extent, the boldness, or the variety of its electric ventures, begun by President Clark and continued by his successor.

When formerly connected as Vice-President with the New Haven Company, Mr. Mellen was stoutly opposed to electric experiment and expansion. But he now inherits an electric policy with its concrete outlays, and the question of his own policy becomes one

of acute interest both to his stockholders and the public. Will he expand or will he contract the plans of his predecessors? Will he meet electric rivalry or ignore it? Will he drop such unprofitable electric lines as the Nantasket branch or try to develop them further? Will he modify operation of apparently profitable branches like the Hartford-Bristol third rail line? Will he favor third rail, or trolley, or neither? Will he approve or veto, for example, an old plan of Presidents Hall and Clark of third railing the New Haven-Derby branch, now that electric rivalry is imminent? Will he develop the Boston suburban electric system with its projected terminal and loop under the South Station, or will he let it remain quiescent? And, in broader aspects, what will be his legislative policy toward competitive electric projects, especially in Connecticut and Massachusetts? Many like questions can be asked both in outline and in detail, but the foregoing are enough to suggest the complex queries as to electric roads which probably the very first year of President Mellen's administration must answer.

The late history of the New Haven Company has had to do much more closely with freight carrying than with passenger traffic. In the year ending Sept. 30, 1887, its receipts were $4,625,283 from passengers and only $2,952,361 from freight. Since then, largely by merger with the New England, a freight carrying road, but also from a general policy of freight development, the ratio has changed until last year its passenger department turned in $22,953,017 and its freight department $23,926,150. Indeed, it may be said, without straining truth, that of late years freight business and its problems have pressed on the company far beyond its capacity to handle them; and the same statement might have been measurably true even if the corporation had been able to meet new freight propositions less suddenly. His special familiarity, both local and general, with this branch of the company's traffic ought to serve President Mellen well in his new office. If he applies most of his surplus beyond dividend requirements to new and improved rolling stock, it will not be surprising. Finally, among his problems of a somewhat different and perhaps minor character, will be the elimination of a certain old family influence, the cutting of considerable red tape, and the centralizing of administration and authority already begun with the successful consolidation a few months ago of the management of the two great divisions of the system. If such a policy reaches the prolix, too localized and outgrown title of the company, it will not go amiss. It is perhaps stated here publicly for the first time that the late President Clark strongly favored the condensation of the "New York, New Haven and Hartford" into the simpler and more expressive "Southern New England." The verbal change would probably have to encounter some narrow local prejudices, but under President Mellen it may be realized.

Freight Movement in Germany and in America.

The effect of the depression in business in Germany which began in 1900, and from which that country now seems to be recovering, is indicated by the total shipments of freight, by rail, which for four years have been in tons of 2,204 lbs.:

1899.	1900.	1901.	1902.
248,218,010	264,968,032	259,379,902	263,552,374

The decrease of little more than 2 per cent. from 1900 to 1901 seems insignificant in this country, where we are accustomed to immensely greater fluctuations; but it must be remembered that for a number of years before 1900 traffic had been growing at a rate theretofore unknown in Germany, where the recovery of business began some years earlier than here. The increase of nearly 7 per cent. from 1899 to 1900 is an example. And it is further to be remembered that an arrest in the growth of business has most of the effects of a positive decline. Industries which have had for years to provide for a growth of 7 per cent. a year prepare for such an increase in the demand, and suffer if it does not come—an experience which manufacturers have often had in this country, and most probably will have again.

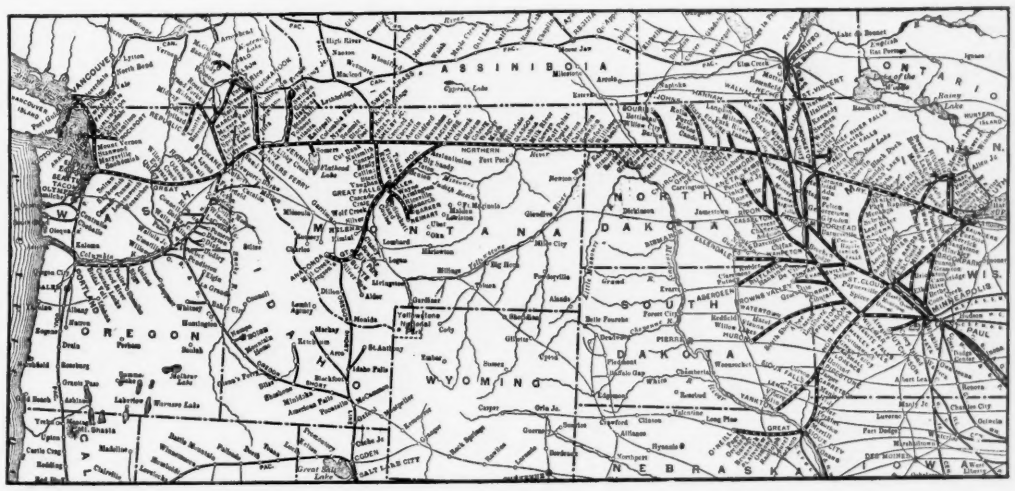
Here, however, we have had at times not only an arrest of growth but a positive decline in traffic which makes the recent German experience appear trifling. As until recently statistics of tons were misleading, because transfers from one railroad to another were duplicated, we give below the aggregate freight movement in the United States in millions of ton-miles:

1893.	1894.	1895.	1896.
93,588	80,335	85,228	95,328

The freight movement in 1893 was the largest ever known. The next year there was a decrease of no less than 14 per cent.—six times the rate of decrease in Germany in 1901; and the decrease here in 1894 was greater than the increase of the two years from 1891 to 1893; while the decrease in Germany in 1901 was little more than a third of the increase in the single year from 1899 to 1900. That the fluctuations should be greater here than in Europe is a natural consequence of the less developed condition of our resources. In no old country is so rapid a growth possible, nor are the consequences of an arrest of growth so serious. Nowhere in Europe would our increase of 65 per cent. in freight traffic from 1897 to 1902 have been possible, or anything like it; it has been one of the greatest marvels in industrial history. No country in Europe to-day has as much freight traffic as the mere *growth* of ours for five years. Of course such a rate of growth cannot possibly continue. Indeed, from 1900 to 1901 the increase was but 4 per cent., while the year before it had been nearly 15 per cent., and from 1897 to 1898 no less than 20 per cent. The increase in the last year reported, to June 30, 1902, was 7 per cent.—or just about equal to the growth in Germany from 1899 to 1900, which was the culmination of a prosperous period.

Great Northern.

With operating conditions in many respects unlike those of any other railroad in the country, the report of the Great Northern is always an interesting document. Mr. Hill is essentially a pioneer, and the results he has obtained by capitalizing his boundless confidence in his Northwest have special interest because they are pioneering results. The Great Northern railroad and the people of the northern part of Montana, North Dakota and Washington are inter-dependent to an unusual degree, and the growth and prosperity of either the railroad or the country presupposes a similar state of affairs with the other.



Great Northern.

One specific point in which the Great Northern differs, at least temporarily, from most of the roads which have been reviewed this fall is in the proportion of operating expenses to gross earnings, which has shown a slight decrease since 1902, in place of the almost inevitable increases reported elsewhere. This percentage is under 50 per cent., remarkably low, although many things have to be taken into account before it can properly be compared with the ratio existing on other railroads. The exact figure for 1903 was 49.23 per cent., as against 49.37 in 1902 and 55.88 in 1901. In the two years previous to 1900 it was even lower, reaching in 1898 48.08, and it then rose in 1901 to the figure quoted above, which is the maximum in recent years. One very direct cause of this low ratio is the high average train load, which increased from 417 tons, in 1902, to 447 tons, nearly, in 1903: an increase of about 7 per cent. But it must be taken into consideration that the character of the freight traffic on the Great Northern permits cars to be held for maximum carloads and train loads to an extent quite impossible on most railroads; a fact which illustrates the fallacy of forming judgment as to operating efficiency solely on a basis of the ratio of expenses to earnings, as has been fashionable in some quarters.

If Mr. Hill in estimating that the three Northern Securities properties would earn an aggregate of 150 millions during the current year slightly overstated the possibilities of the northwestern States, the increase which these roads have made in gross earnings is, nevertheless, excellent. The changes made by the Northern Pacific are considered elsewhere in this issue. The Great Northern's share of the current prosperity is shown by an increase in gross earnings from $36,032,256 in 1902 to $40,785,647 this year. As against this increase of $4,753,391, operating expenses increased $2,287,665 to a total of $20,076,829; income from operation, after deduction of taxes, was $19,234,692, as against $17,003,398 last year, and gross traffic earnings per mile of road were $7,429 as against $6,864 last year. Operating expenses per mile were $3,657 as against $3,388; and net earnings were $3,772 as against $3,475; the average mileage worked increasing from 5,249 to 5,490.

Another point of dissimilarity between the Great Northern and the majority of American lines at the present period of their development is the characteristic of continuous extension into new territory, in place of rebuilding and bettering lines already in existence. It is evident that the property has not yet attained its full growth, and the fact that $7,400 a mile can be earned while the road is still pioneering, is an indication of great promise. It is true that considerable betterment work was done during the year, including progress on new yards and terminals, passing tracks, relaying of 180 miles of line with heavier rail, etc., but the opening of 374 miles of new line for traffic, and the statement of additional building in progress or located for work in the immediate future to the extent of some 300 miles more, is much more significant at present than the betterment work. The report is incomplete in that the apportionment between income and capital of the cost of new lines is nowhere stated in detail, but $3,000,000 was appropriated out of surplus earnings for "permanent improvement and renewals," and the maintenance charge for the year amounts to $5,273,099, exclusive of maintenance of equipment. Nearly 1½ millions of this charge was for extraordinary improvements; the total is at the rate of about $960 per mile.

There has been no increase in authorized capital stock during the year, the amount remaining at $125,000,000. The stock issued increased by $143,750, of which $140,000 was transferred to the Great Northern Employees' Investment Co., which exists for the purpose of enabling old and faithful employees to secure holdings in the railroad. The total increase in capital liabilities since the last report is $5,789,176, against which is set an increase of $15,014,071 in capital assets.

The chief traffic changes reported are a considerable decrease in eastbound wheat, amounting to 1,830,892 bushels, with a decrease of $341,965 from last year's wheat earnings, and an increase of $819,589 in the earnings from iron ore traffic. The increase in earnings from freight other than wheat and iron ore amounted to over three millions. This increase was general over the entire system except on the Willmar & Sioux Falls. The general downward tendency of freight rates on the system in the last 20 years is graphically shown in the following table:

Year.	Ton-miles.	Ton-mile revenue.
1883.....	341,539,997	1.968 cents
1893.....	1,093,692,312	1.190 "
1903.....	3,606,835,176	.857 "

Northern Pacific.

The showing made by this property in the 1902 year might fairly have been called phenomenal. The current report is also remarkably good, the increase in gross earnings since last year amounting to over 11 per cent., and although the gain is very much less than for 1902, both in the aggregate and in proportion, gross earnings per mile of road have increased from $8,245 to $9,027. The excellence of these returns is even more striking when it is considered how large a proportion of the mileage, amounting to over two-thirds of the total, lies in the comparatively undeveloped States of Montana, North Dakota and Washington. In fact, the 11 hundred miles in Minnesota and the short Wisconsin line constitute nearly the entire mileage in what at first sight looks like traffic country. Six years ago, the density of traffic on the Northern Pacific was expressed by 48,054 passenger-miles and 370,969 ton-miles per mile of road worked—being 419,023 of what the Illinois Central calls "units of public service"—and gross earnings per mile were $5,429. The current gross earnings per mile of $9,027 were derived from 92,870 passenger-miles and 746,468 ton-miles per mile; 839,338 units of service. This, of course, is on a single track road, but it was pointed out in the *Railroad Gazette* last year that there were only one or two roads in the west which could make so good a showing in gross earnings per mile. By way of further illustration, the following table has been compiled, giving gross earnings per mile of the Atchison, Milwaukee, Alton, Burlington, Southern Pacific and Canadian Pacific, in comparison with the Northern Pacific. In certain instances the figures for 1903 are not yet available.

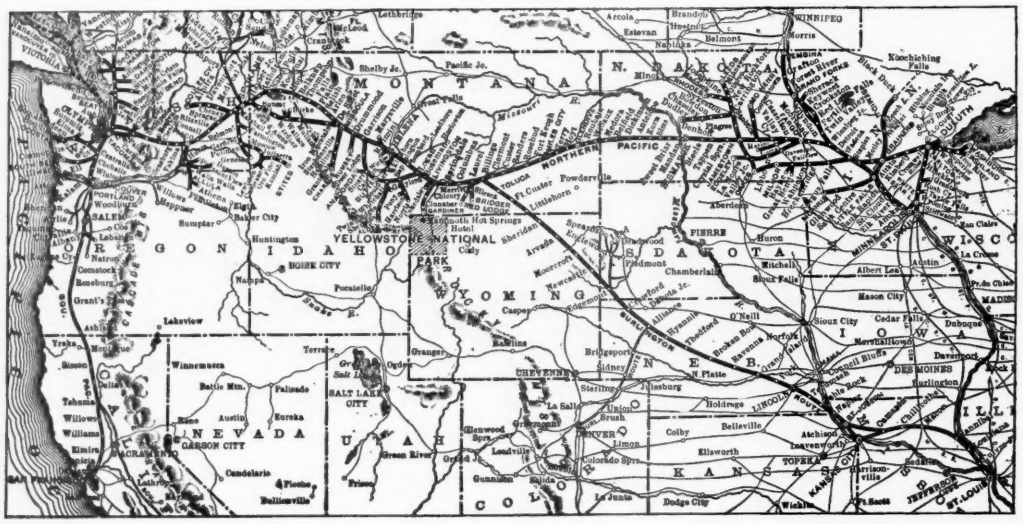
	—Gross earnings per mile.— 1903.	1902.
Atchison, Topeka & Santa Fe....	$7,828	$7,528
Chicago, Milwaukee & St. Paul...	7,171	6,906

Chicago, Burlington & Quincy...	...	6,634
Southern Pacific	...	9,540
Chicago & Alton	...	10,032
Canadian Pacific	5,673	4,943
Northern Pacific	9,027	8,245

Total gross earnings for the year were $46,142,105, comparing with $41,387,380 in 1902 and $32,560,983 in 1901, the gain in the last two years amounting to $13,581,122, or 41 per cent. Operating expenses were $24,032,093 this year, and net income was $21,801,129. From this, $7,055,239 was paid for interest and rentals, $10,074,943 was divided among the shareholders, $3,000,000 was appropriated for additions and betterments, and $1,670,946 was added to the surplus balance carried forward. This surplus now stands at $9,725,655.

The increasing preponderance of eastbound traffic over westbound is quite noteworthy, occasioned by the growth of lumber and shingle shipments from the Pacific coast, which is not balanced by any corresponding increase in westbound freight. Loaded car mileage eastbound increased 16.7 per cent. during the year, as against an increase of 5.2 per cent. westbound. This would naturally tend to affect net train load adversely, on account of the necessary mileage of cars hauled west empty or only partially loaded, but train load, if company's freight be added to revenue freight, has continued to gain, notwithstanding, and the average for the current year is 402.3, as against 400.9, last year. Revenue train load decreased, however, from 346 tons to 344, presumably through the cause named above.

The large amount of traffic moved during the year was handled without unusual difficulty, and considerable relief was afforded by the new passing tracks. Sidings and



Northern Pacific.

spur tracks built during 1903 (fiscal year) aggregated 124 miles, and a similar amount was added in 1902. But portions of the line are now being worked at about the limit of single track capacity, and double tracking from Staples, Minn., to Wadena Junction, 19 miles, is recommended by the General Manager; and its ultimate extension west to Winnipeg Junction and to Fargo, N. Dak., is in view. The heavy traffic and heavy engines made it advisable to increase the standard size of main line rail from 72 lbs. to 85 lbs., and 104 miles of main line was relaid with this new rail during the year. The total mileage of main line laid with 72-lb. rail is now 1,575, and only 239 miles of the total 2,750 accredited as main line is laid with less than 66-lb., although nearly 2,000 miles of branches are laid with 56 lb. rail. Considerable grade revision and bridge work was also done during the year, the total number of bridges replaced amounting to 286, exclusive of seven eliminated by line changes. Steel trusses were substituted for seven of the replaced bridges, plate girders and I beams for 24, and embankment for 91. The balance, 164 in number, were replaced by timber structures.

Important purchases of equipment were made during the current year. The amount charged to capital for this purpose was $3,924,299, and replacements aggregating $500,353 were made from income. The net increase of locomotives during the year was 106, which is equal to 13.3 per cent. of the 796 owned last year. The new motive power increased the aggregate total weight on drivers 20.9 per cent., and the aggregate total weight of engines 31.5 per cent. The net addition to passenger equipment was 39 cars; the net increase in freight equipment was 1,100 cars, and the average car capacity now stands at 28.2 tons, as against 27.4 last year. The maximum capacity of cars bought was 80,000 lbs., and 1,675 cars of this capacity were added to the equipment, out of a total of 1,684 bought.

Denver & Rio Grande.

Although the gross earnings of this company for the fiscal year just ended were $17,304,560, an increase of $267,731, the gain was more than offset by an increase of $298,308 in operating expenses which left a decrease in net earnings of $30,577. Freight and passenger earnings show large gains, but the net was reduced by the increase in conducting transportation and in maintenance of equipment. The increase of $224,536 in the maintenance of equipment account is due to the policy of the company of keeping its equipment on a par with the increased mineral traffic of this road which has been steadily growing since its consolidation with the Rio Grande Western and its affiliation with the Utah Fuel and the Colorado Fuel & Iron Companies. During the past two years the company has expended altogether $3,874,099 for equipment, of which $103,800 was charged to renewal fund, $500,000 to income, and the remainder to capital account. The result of this expenditure is evident in the increased average train load, which was 205 tons this year against 199 tons in 1902. The large increase of $241,733 in conducting transportation was due to the familiar increase in the cost of fuel and labor which has been evident in almost all railroad reports of the past year. After providing for interest on funded debt, taxes, rentals, and dividends of 5 per cent. on the preferred stock, the company has a surplus for the year of $622,562. From this was taken a sum of $436,797 for betterments and for worn out narrow-gage equipment, leaving a total surplus of $185,765 as against $362,625 in 1902. This is healthy and conservative financiering.

Freight earnings for the year were $12,281,492, an increase of $131,464, and passenger earnings were $3,827,924, an increase of $133,039. The gain in freight earnings was due to a heavy increase in the tonnage of bituminous coal, precious ore and coke which more than offset the slight losses in freight tonnage and other materials. Gross earnings per mile increased from $7,259 to $7,277, but net earnings decreased from $2,857 to $2,807 per mile. The number of revenue tons increased from 6,507,124 to 6,766,675 tons, but as the average freight haul decreased seven miles, the revenue ton mileage also showed a decrease of one and a half millions.

There were issued during the year $2,400,000 of first consolidated mortgage 4 per cent. bonds of the Denver & Rio Grande, and $400,000 of the first consolidated 4 per cent. mortgage bonds of the Rio Grande Western, making an increase in the funded debt for the past two years of $4,800,000. The proceeds from the sale of these bonds were divided as follows: $3,400,000 for the purchase of new equipment; $850,000 for the purchase of the North Fork branch, and $550,000 for improvements on the main line.

Wisconsin Central.

The report of this company for the fiscal year ended June 30 shows a surplus over all charges of $724,074 as compared with the surplus of $480,105 in 1902. Gross earnings were $6,651,863, an increase of $610,393, and operating expenses increased $322,620, leaving a gain in net earnings of $287,772. This was earned on the same number of miles and the ratio of earnings to expenses compares favorably with the previous year, being 63.23 as against 64.28. Changes in the charge for maintenance of way were slight, but considerable increases were shown in maintenance of equipment, chiefly due to heavy repairs made on a large number of locomotive and freight cars. Details of income account for the last two years, with changes, are shown in the following table:

	1903.	1902.	Increase.
Average miles operated...	977	978	...
Gross earnings	$6,651,863	$6,041,470	$610,393
Operating expenses	4,205,994	3,883,374	322,620
Per cent. expenses.....	63.23	64.28	...
Net earnings	$2,445,869	$2,158,097	$287,772
Interest, taxes and rentals.	1,721,795	1,677,992	43,803
Surplus	$724,074	$480,105	$243,969

The better operating results for the year are largely due to the grade and terminal improvements which have been made during the past two or three years. During the last year a sum of $485,273 was expended for improvements. The chief items were $151,956 for a new ore dock; $81,576 for terminal improvements, and $143,913 for revision of grades and track renewals. Of this sum, $424,639 was appropriated out of the year's surplus earnings, and the remainder provided for by the sale of bonds.

An increase of $575,599 was shown in freight receipts, but the average per ton-mile was less. The ton mileage increased about 100,500,000, and the revenue train load increased from 287 tons to 304 tons. The company's train load has shown gains during the last three years. Gross earnings per mile increased from $6,178 to $6,808, while net earnings increased from $2,207 to $2,503 per mile. Certain of these figures are given below:

	1903.	1902.
Tons moved	4,316,300	4,004,906
Tons moved one mile.....	737,111,311	636,393,127
Freight train miles.....	2,427,389	2,220,212
Average freight haul, miles.....	170	158
Av. receipt per freight train mile.	$2.07	$2.03
Av. receipt per ton mile (mills)..	.682	.709
Average revenue train load.....	304	287

NEW PUBLICATIONS.

Trust Companies of the United States. 228 pp., size 8½ in. x 11 in. Compiled by The Audit Company, 43 Cedar street, New York.

Every one observant of financial events and of the machinery for financing has watched with exceeding interest, and with some apprehension, the growth in number and in size of the trust companies during the past few years. This volume gives a list of 912 companies, with their assets and liabilities (as of June 30, 1903) in detail, and the names of officers and directors. No summary of statistics, or comment, is given, and therefore the only facts easily available are those relating to any one company of which the user of the volume wants information. Nevertheless it is possible to obtain from the lists some interesting facts: Of the 912 trust companies in existence June 30, 1903, 390 have been organized during the past 2½ years. The State of Alabama has only 10 companies with about six millions gross assets, while the city of New York has 39 companies with about one billion dollars gross assets. Chicago has 14 companies with 227 millions; Pittsburg, 31 companies, 130 millions; Philadelphia, 43 companies, 287 millions; Boston, 17 companies, 139 millions. The attractions for depositors are interest on deposits and check facilities similar to those of the national banks. The attractions for the investor are easily seen in the fact that substantially all the trust company stocks are quoted far above par; but this is modified by the fact that in most of the new companies the subscribers to stock usually subscribe also to a surplus fund. A trust company can lawfully loan a larger proportion of its money than can a national bank, and by so much it can make more money. It appears to be dangerous but it seems to be profitable.

The Financial Red Book of America. 388 pp., size 7½ in. x 10 in. Price $10. Published by The Financial Directory Association, 25 West Broadway, New York.

This remarkable compilation is a list of about 15,000 citizens of the United States who are estimated to be worth $300,000, or more. Beyond this minimum statement, no estimate is made of the wealth of each one, but the calling, or profession, is given together with lists of corporations in which they are officially interested. A study of it indicates that it is reliable only so far as such information might be expected to be. That such a compilation has a value is beyond doubt, but a not altogether agreeable result will surely be that the book will be used as an addressing list by beggars and promoters. There are also, it appears, many widows and maidens, all over the country whose wealth is by so much placed on exhibition. There is no use in denying that there is a weird and probably unhealthy charm in remembering the names of one's friends and acquaintances, and looking them up in this list.

The Mechanical Engineer's Pocket Book. By the late D. K. Clark. Fifth edition revised and enlarged by H. H. P. Powles. New York: D. Van Nostrand Company, 1903. Leather, $3.00.

Mr. Clark died at the time the third edition of his pocket-book was being issued, so that the fourth edition was a reprint of the third. Preparatory to the issuance of the fifth edition it was necessary to have it revised and brought up to date, for which work the services of Mr. H. H. P. Powles, M. Inst. C. E., were secured. Much new matter has been added, the present volume being about 40 pages larger than the preceding edition. The section on Electrical Engineering has been largely rewritten and added to, although alternating currents are given only brief consideration. The reason for this is that the subject is too broad to be given adequate treatment in a work of this character. At the end of the book are given, complete, the revised 1903 electrical wiring rules of the Institution of Electrical Engineers of Great Britain.

TRADE CATALOGUES.

The Link-Belt Engineering Company, Philadelphia, Pa., has a two-part pamphlet devoted to shallow trough belt conveyors, and coal and coke crushers respectively. In reference to belt conveyors it says that as no form of conveyor as yet devised is of universal application, a great variety is offered to meet the different needs. Deep troughing is objectionable and it can be laid down as an axiom that the more nearly a belt conveyor approaches the old style of flat belt the longer will it last. Half-tone engravings from photographs of a variety of features

and applications are shown. In the second part of the book different kinds of coal and coke crushers are illustrated and described.

Perkins Goods, the latest catalogue of The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn., has just been issued. It is pocket size and contains about 1,200 articles, including a large variety of sockets, receptacles, rosettes, single-pole, three-point and double-pole switches for different voltages and currents, knife switches, cut-outs, fuses, cluster balls, shade holders, fittings, etc. The illustrations are half-tone engravings from photographs of the articles.

Triplex Hoisting Hints is an attractive little pamphlet of the Yale & Towne Mfg. Co., New York, to show applications of triplex chain blocks in large manufacturing and industrial plants. The book is filled with half-tone engravings from photographs taken in the plants, and well illustrates the variety of applications to which these blocks are adapted.

Joseph T. Ryerson & Son, Chicago, have sent out catalogue No. 7 of "Ryerson's New Technical Library," which shows the several designs of the Lennox rotary bevel shear and the Lennox rotary splitting shear. Illustrations of the character of work done by the machines and testimonials from prominent users are also given.

The New Wheel Shop at Altoona.

The new wheel shop of the Pennsylvania at Altoona, built a few months ago, is now in full operation. It is between the foundry and the machine shop, and next to the boiler shop. A general plan with the arrangement of the machinery is shown in Fig. 1. The shop is motor-driven, the larger and heavier machines having individual motors and the group system being used for the smaller tools.

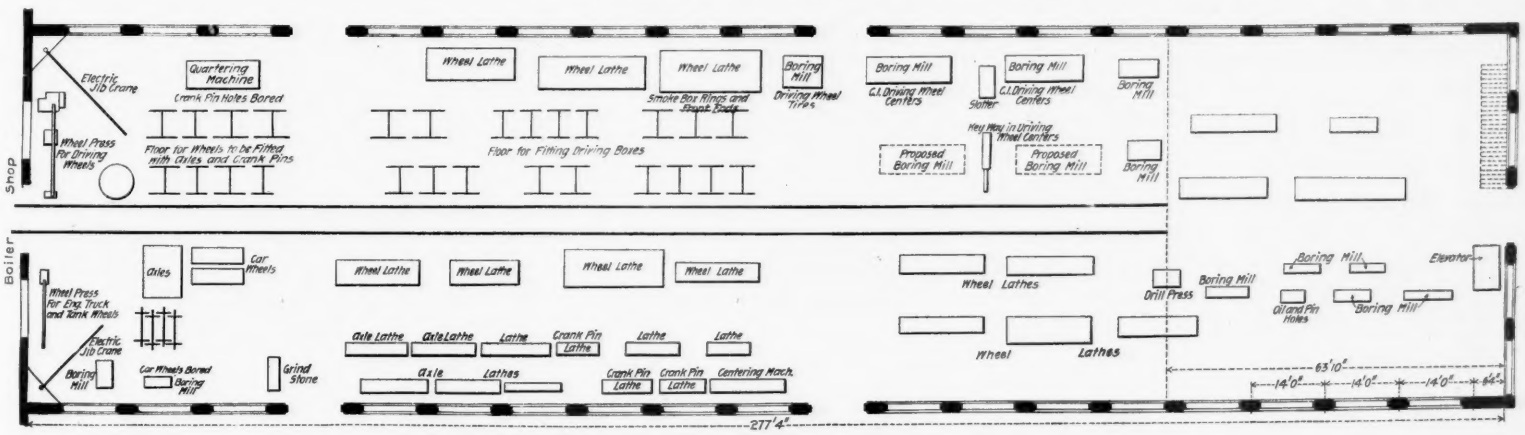


Fig. 1.—Plan of Altoona Wheel Shop Showing Arrangement of Machinery.

There is a space of about 64 ft. at the southeast end of the shop in which is a balcony. This balcony is used for fitting eccentric straps and holds a few light tools driven by a single motor. Beneath it are five horizontal boring machines, a radial drill and an emery wheel and surfacer, besides two small driving-wheel lathes. These tools are divided into two groups, to one of which should be added two heavy planers. In addition to the above there are a heavy Bement slotter, a miller and two planers, each driven by an individual motor.

The space not covered by the balcony is served by a traveling crane spanning the width of the building and reaching all of the tools except two hydraulic wheel presses at one end of the shop. Each of these is served by an electric jib crane. Under the traveling crane are the heavy tools belonging to the driving wheel-department, each with an individual motor. They consist of two slotters, nine large driving-wheel lathes, a double-ended axle lathe, a double-ended car-wheel lathe, five vertical boring mills, a quartering machine and a miller. Along one side of the shop are a number of lathes divided into two groups, each driven by a single motor.

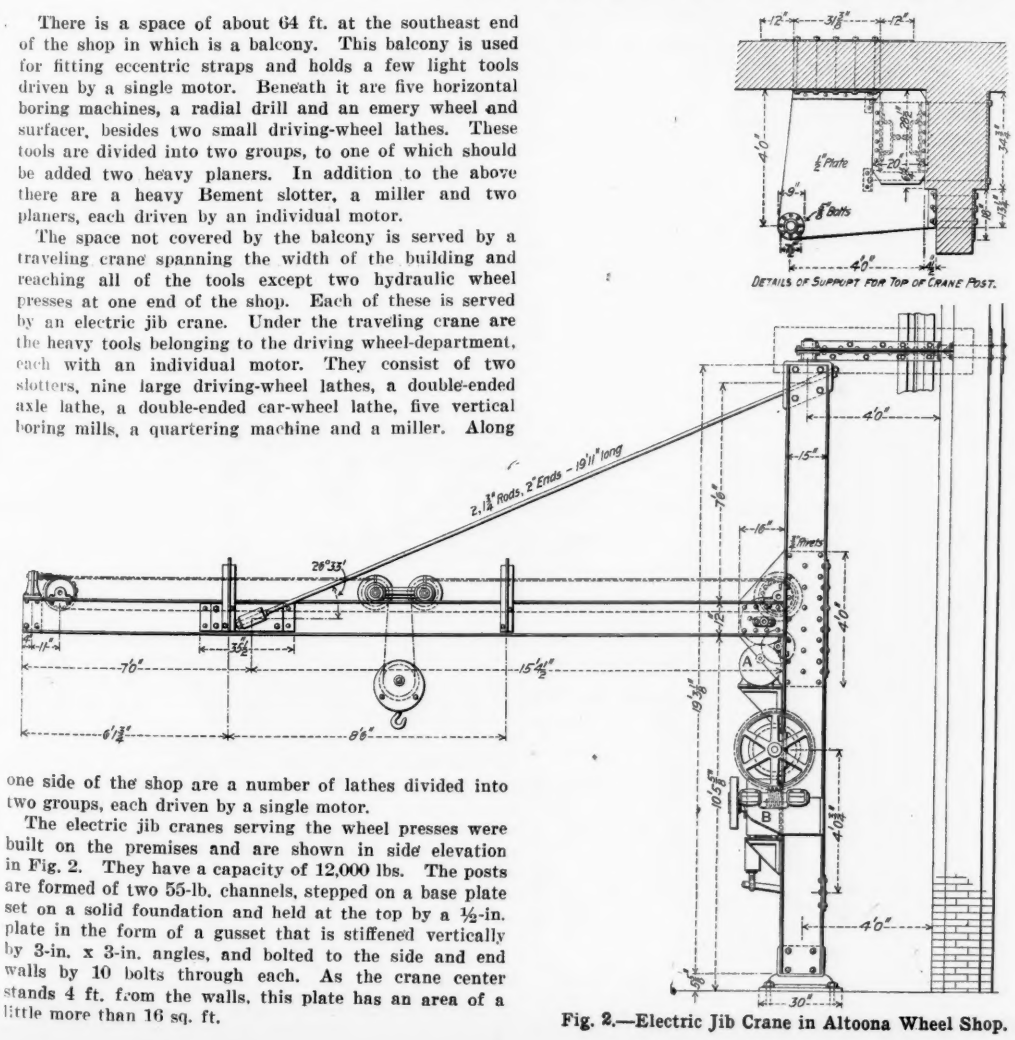


Fig. 2.—Electric Jib Crane in Altoona Wheel Shop.

The electric jib cranes serving the wheel presses were built on the premises and are shown in side elevation in Fig. 2. They have a capacity of 12,000 lbs. The posts are formed of two 55-lb. channels, stepped on a base plate set on a solid foundation and held at the top by a ½-in. plate in the form of a gusset that is stiffened vertically by 3-in. x 3-in. angles, and bolted to the side and end walls by 10 bolts through each. As the crane center stands 4 ft. from the walls, this plate has an area of a little more than 16 sq. ft.

A Bonus That Never Materialized.

BY L. R. ANDREWS.

A recent press despatch announced that Engineer Warboy, of the Southern California Railway, was promised a bonus of $50 a minute for each minute that he cut off from the schedule of Mr. Lowe's speedy special between San Bernardino and Los Angeles. This train, which eclipsed all former records from Chicago to the Pacific ocean, ran the 60 miles between San Bernardino and Los Angeles in 62 minutes, thereby earning the nervy engineman a prize of $450.

Just 20 years ago, in September, 1883, Henry Villard completed the Northern Pacific Railroad; and in honor of the event all the railroads running out of St. Paul and Minneapolis tendered the distinguished President excursions over their lines, extending the invitation to all the prominent business men and representative citizens of the Twin Cities.

It was a railroad jubilee and the various lines vied with each other in providing entertainment for their honored guest and his party.

I was firing a night passenger run, trains 3 and 4, between St. Paul and Fergus Falls, a distance of 187 miles, on the old St. Paul, Minneapolis & Manitoba, now the Great Northern Railway. Jim Kern was my engineer and our regular engine, a 4-4-0 McQueen, 17 x 24, with 68-in. drivers, was in the back shop for a general overhauling. We called them eight-wheelers in those days.

The schedule on the run was slow and we managed to make time with a nondescript freighter as heavy-footed as a traction engine. She was of the same type and cylinder dimensions as our McQueen, but had smaller wheels. Jim declared that the old cow interfered and swore that she ran faster shut off than when working steam. The alkali water raised hob with the particularly tender flues on that batch of engines, and the 187 was no exception to the rule.

On arrival at St. Paul one morning in September, Jim reported her for a washout and flues to be caulked. I went to bed and in spite of the blistering heat fell asleep. About 2 o'clock that afternoon the call boy banged on the door and informed me that the 187 was marked up for Villard's special to Fergus Falls at 4 o'clock and asked me whether I wanted to go on her. Learning that Jim was going to run her, I told the kid I would go. I had in mind the acceptable extra money made by the enginemen who went out on Jim Hill's special, which consisted only of his private car, and I supposed that Villard's special was in the same class.

I hurried to the roundhouse, drew my supplies, filled the headlight, lanterns and gage light. I found the old mill had been blown off and washed out; and being the only available engine for the special, she was quickly fired up. A steam hose led from the dome of a live engine on an adjoining pit to the dome of the 187 and the steam forced into her was utilized to hurry her fire by means of the blower.

It was a hurry order, for when Jim Hill says "thumbs up," everybody gets busy. The end does not always justify the means, however, and in this instance the expedient proved a fatal one. As quickly as possible the hostler ran the 187 on the table where she was turned to back down to the levee, three miles distant. I loaded her up and the blower set her stack to humming like a hive of bees. The coal was abominable. "Jim Hill's Iowa real estate" we called it, as it came from some lig-

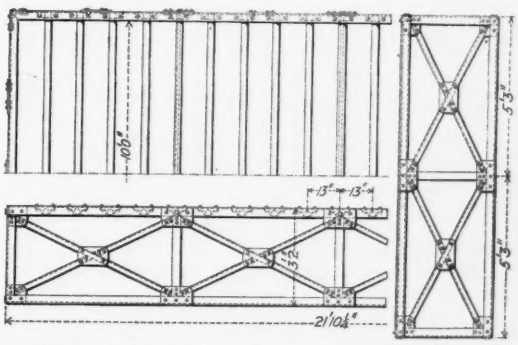


Fig. 3.—Driving Wheel Rack—Altoona Wheel Shop.

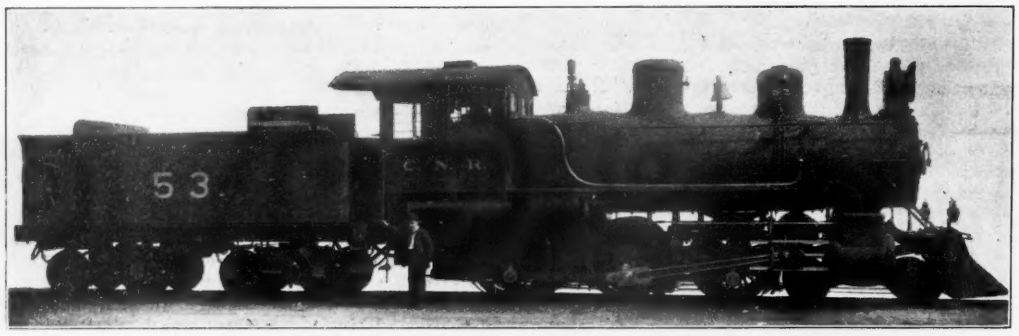
nite mines he owned in Iowa. The r.o.m. ranged on assay from half formed peat to sulphurets with a large percentage of iron pyrites.

By the time we reached the Union Depot on the levee, I had her clock wound up to the limit, 140 lbs., and was digging frantically at the coal gate with the pick to loosen up the clods, turf, dust and ore on her tank in readiness for the hill. There is a 3 per cent. grade out of St. Paul for a distance of five miles.

When I sized up that special I got cold feet. There was a baggage and an express car loaded to the roof with ammunition, wet and dry. Then came seven day

coaches and Mr. Villard's private car. Every coach was crowded with heavy weights. I knew that string of varnished cars would hang back like a bashful boy, but it was too late to sidestep.

Jim Kern met us at the levee, and after we coupled on and tried the air he got down to drop a little blackstrap on her. "Load her up and get her hot for the hill," said Jim, and I opened the door to comply. Holding the shovel upside down in the door to locate the bright spots in her fire, I happened to glance at her flue sheet. The water was running down the face of it in a cataract and a black streak along the front of her fire-box showed where the fire was drowned out.



Ten-Wheel Locomotive for the Canadian Northern.

I blew her up good and strong and told Jim about her leaky tubes. "That settles our bonus," declared Jim. "The old man told me that if we got 'em to Fergus in five hours, there was $300 to be divided among the train and engine crews. If we get there in a week we'll do well with this roadsprinkler. She won't hold coarse potatoes," he growled disgustedly.

This is the gist of Jim's remarks after winnowing out the picturesque expletives and other emphatic interjections. This was the first intimation I had heard of a bonus and I wished most heartily for the smart McQueen.

Finally we got the signal to go. Under strict orders we were obliged to reduce speed to three miles an hour over Third street, which was at the foot of the heavy grade leading to Hamline, five miles north. The 187 was red hot, but she laid down on the hill with the white flag flying from her dome. A switching engine boosted us over the hill and under these inauspicious circumstances began our trip to Fergus.

At Minneapolis Junction, Jud Rice, Superintendent of the division, came forward and pre-empted my seat-box, remarking that there was no room for him in the coaches. Jim pounded the freighter on the back good and hard over the prairie, but the heavy train wheeled hard. When we reached the sag through which meandered Coon Creek Jim hooked her up to get a run for the hill on the other side. Half way down the hill a veal calf wabbled onto the track and refused to scare at the whistle or cylinder cocks.

Jud Rice was very particular about striking stock, but Jim knew if he stopped for the pesky maverick it would be a case of stall on the hill beyond the creek. He glanced at the Superintendent, who sat with closed eyes as if meditating on the chances of our getting to Fergus that week. So Jim closed his front window and the festive calf gave me a hard day's work by mussing up the old mill until she looked and smelt as if she had collided with a slaughter house. I heard Jud Rice mutter as he sniffed disgustedly, "Phew! the d—d critters haven't as much sense as a white pine dog with basswood brains."

The non-lifting injector on the 187 wouldn't supply her and Jim put the pump to work. It was bitter grief to keep a hundred and enough on her with her leaky flues and the poor coal, and when the pump went to work Jud Rice watched her clock unwind to 105 with a look of pained resignation. At Elk River the air chamber of the pump burst and it was a game of hide and seek to find the water in her glass after that.

At St. Cloud, 75 miles out, machinists met us with a top air chamber for the pump which they repaired while we took coal and water. We got a tank of Briar Hill coal that had come from Ohio via Duluth. This is extra fine fuel. But the new fireman who was ordered on to spell me could do nothing with her and the needle leaned over to his side more and more. He could not keep her as warm as I did with the real estate.

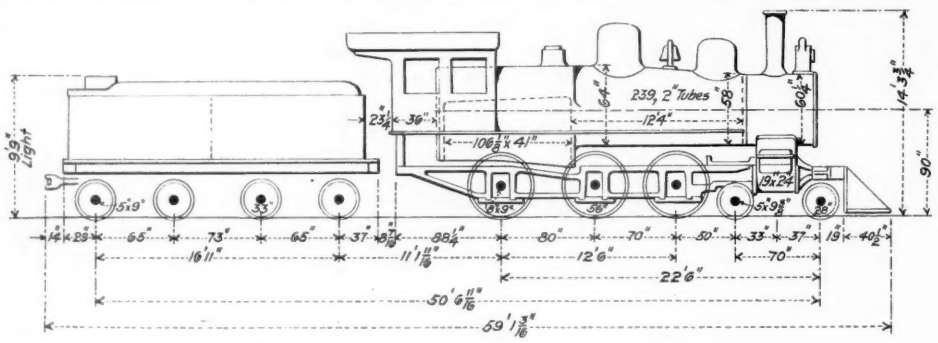
We reached Alexandria with 80 lbs. of fog and a rotten fire. While I took water the fat fireman cleaned her fire and ashpan. He swore that the slag from the real estate had run down through her finger grates and formed castings beneath and passed some sarcastic remarks about running a portable smelter.

Meanwhile every official and semi-official on the train, from Allen Manvel, General Manager, down to the Superintendent's stenographer, came forward and made caustic comments for the benefit of Jim, who was greasing her bearings. We stood there 20 minutes to blow her up; and I made a resolve that the next call-boy who summoned me for a special would need a body-guard.

We finally reached Fergus, tired and disgusted, about four hours behind schedule, and turned the special over to the Northern Division with wishes for better luck. No one dared whisper "bonus," and I do not recommend trying to make a record run with a locomotive whose boiler won't hold coarse potatoes.

Ten-Wheelers Built by the Canadian Locomotive Company.

The Canadian Locomotive Company has built for the Canadian Northern 25 4-6-0 locomotives, illustrations of which are shown. They are moderate in size, weighing 133,000 lbs., with 107,000 lbs. on drivers. The boilers are Belpaire narrow fire-box, carrying 180 lbs. pressure, and having 1,691 sq. ft. of heating surface, of which 155 sq. ft. or 9 per cent. is in the fire-box. There are 239 2-in. tubes 12 ft. 4 in. long, the area of the cross-section of the 58-in. boiler taken up by the tubes being 27.5 per cent.



Elevation of Canadian Northern Ten-Wheeler.

The cylinders are 19 in. x 24 in. and the drivers 56 in., enabling a tractive effort of 23,670 lbs. to be exerted. The special equipment includes Ohio injectors, Crosby & Richardson safety valves, Westinghouse-American brakes and Sterlingworth brake-beams. Other dimensions are:

Wheel base, rigid	12 ft. 6 in.
Wheel base, total	22 ft. 6 in.
Length over all, engine and tender	59 ft. 1 3/16 in.
Height to center of boiler	7 ft. 6 in.
Heating surface, fire-box	155 sq. ft.
Heating surface, tubes	1,536 sq. ft.
Heating surface, total	1,691 sq. ft.
Grate area	30 sq. ft.
Driving wheels, diameter	56 in.
Driving wheels, material of centers	Cast Iron
Diameter and length of journals	8 in. x 9 in.
Truck wheels, diameter	28 in.
Weight of tender, loaded	101,000 lbs.
Capacity of tank, imperial gals.	4,500
Coal capacity	9 tons

The Bagdad Railway.*

The Bagdad Railway, which has long been under consideration, has at last taken practical shape, and on March 5, 1903, the Anatolia Railway Company obtained permission from the Ottoman Government to build and operate for 99 years a line between Konieh, Adana, Mosul, Bagdad, Zobeir and Bassorah, with various branches, among them one from Zobeir to some point on the Persian Gulf.

Konieh is the terminus of a line, which by way of Eskichehir, runs to Scutari on the Asiatic shore of the Bosphorus opposite Constantinople. The only object of running the new line through Bagdad is to put the Turkish Government in rapid communication with the provinces, whose dependence is more or less nominal. The main object is to cross Asia Minor diagonally and to unite Constantinople with the Persian Gulf by rail, giving Europe a new direct and rapid route to the Far East. The existing line between Scutari and Konieh, of which the Bagdad line is really a continuation, is worked by the Ottoman Anatolia Company, so that this company was in a favorable position to obtain the new concession. The preliminary location made by a commission which visited the country for the purpose has been approved by the Government.

From Konieh the line is to run south, crossing the fertile plain of Karaman, and then east to the foot of Mt. Taurus, a distance of about 124 miles. The line curves round Mt. Taurus at a height of 4,800 ft. and then descends to Adana. This section of 88 miles is the most difficult on the line on account of the nature of the ground.

From Adana the line ascends again to the northeast, crossing Mt. Amanus at a height of 3,180 ft., and then descends southward into the plain, where it turns east, passing about 31 miles north of Aleppo, this important town being connected with the main line by a branch. It crosses the Euphrates 12½ miles south of Biredjik, and reaches Mosul on the Tigris by way of the northern end of the plains of Mesopotamia, and then runs down the right bank of the Tigris to Bagdad. A branch line just outside of Bagdad connects with Hanikin, a trade center on the Persian frontier.

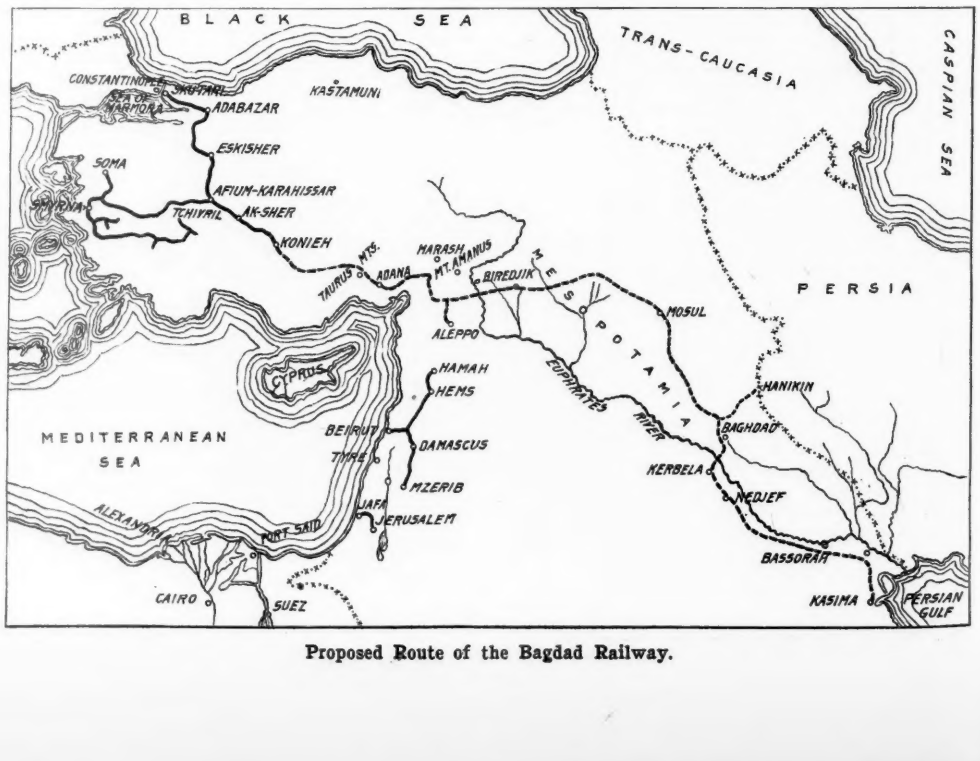
After passing Bagdad the line again crosses the Euphrates, running down the right bank to Zobeir, from which place a branch line 12½ miles long goes to Bassorah. The main line then runs south to some port on the Persian Gulf. The port at present suggested is Kasima, but it may be changed to Koweit or some other port.

The lengths of the different sections are as follows:

	Miles.
Konieh to Mt. Taurus	124
Mt. Taurus to Adana	102½
Adana to Euphrates	208
Euphrates to Mosul	351
Mosul to Bagdad	230
Bagdad to Nedjef	106
Nedjef to Zobeir	233
Zobeir to Kasima	68½
	1,423
Branches—	
To Aleppo	31
To Hanikin	68½
To Bassorah	12½
	112
Total	1,535

The building of a standard-gage line across Mt. Taurus

*Translated abstract from the *Revue Generale des Chemins de Fer et des Tramways*, August, 1903.



Proposed Route of the Bagdad Railway.

is difficult, necessitating large earthworks and numerous tunnels, the total length of the latter amounting to upwards of 5,500 yds. The crossing of Mt. Amanus presents the same difficulties in a lesser degree, and the construction of the section across Mesopotamia, while easy as far as the ground is concerned, is hard, owing to the desert and the difficulty of communication. The section between the Tigris and Euphrates will be expensive on account of the embankments and draining necessary to protect the line from floods.

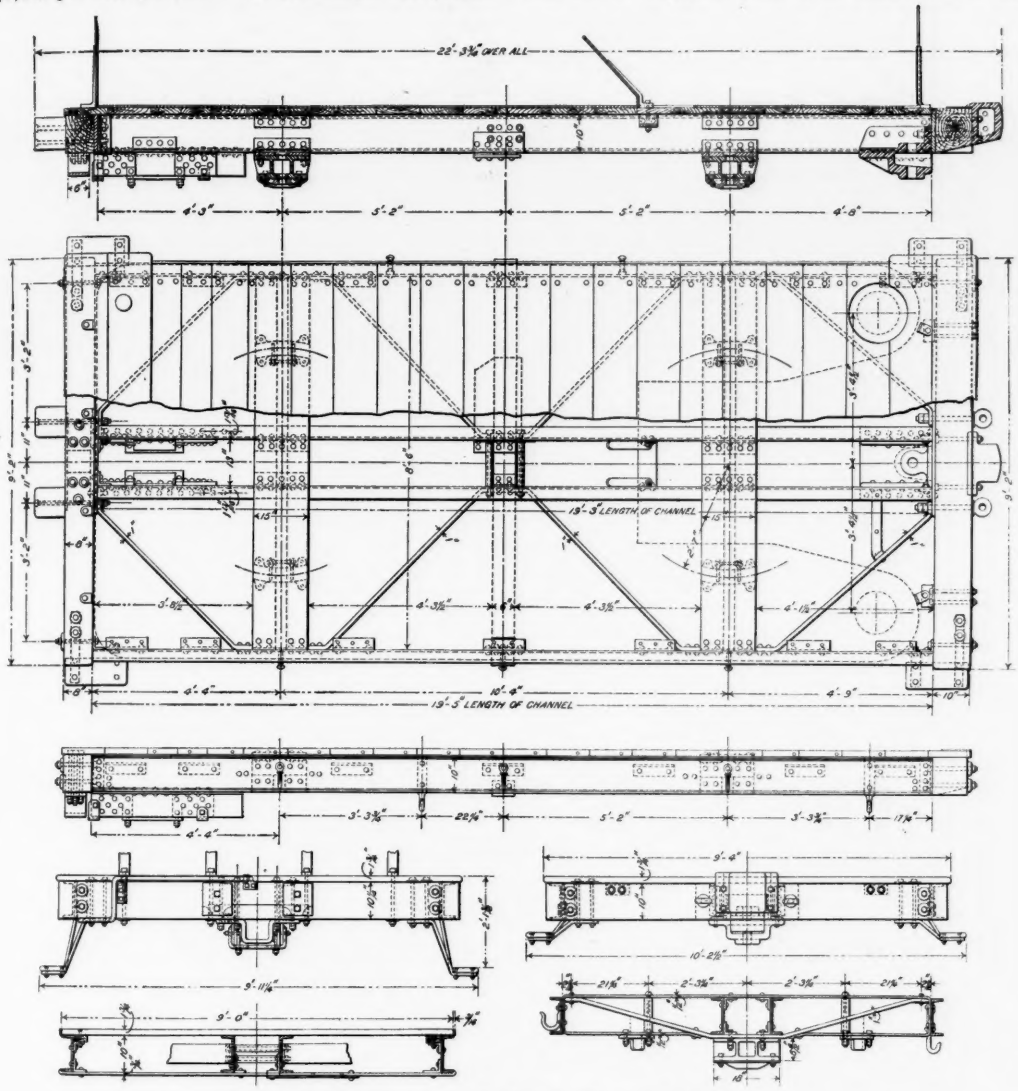
The estimated cost will be $86,000 per mile, on which the Government guarantees interest at 4 per cent., say $3,440 per mile per year. The Government also guarantees $1,450 per mile per year to cover running expenses. The entire line is to be built in 8 years in sections of at least 125 miles. Arrangements will be made with the Government to secure the guarantees for each section before work on it is begun, and the time occupied in arranging these points is to be added to the 8 years allowed for construction.

In accordance with the terms of the agreement, the Anatolia Company has transferred the concession to the Imperial Ottoman Bagdad Railway Company, which has been specially formed to build the road. At present the 124 miles between Konieh and the foot of Mt. Taurus, which is easy to build, has been definitely decided on, and plans are now in preparation for Government approval.

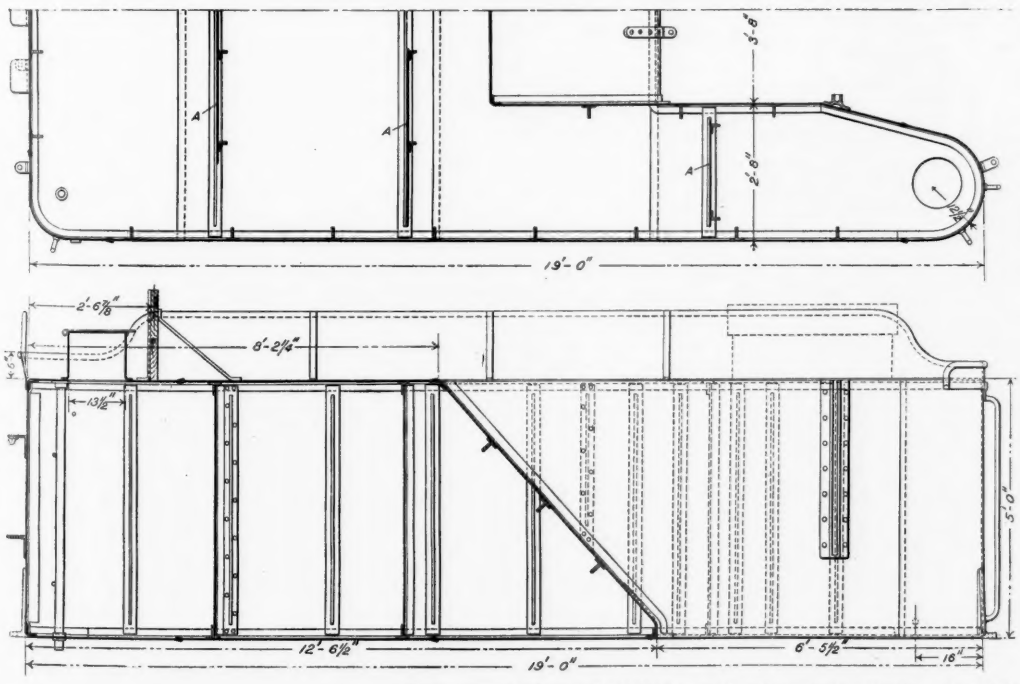
Norfolk & Western 5,000-Gallon Tender.

The design of 5,000-gal. tender shown in the accompanying engraving has been carefully worked out by the Norfolk & Western. The frame is made of steel channels and an important point in its construction is that no holes are drilled through the flanges of the side sills, and only a few through those of the center sills at the ends.

The method of putting in the diagonal bracing to hold the framework square is very efficient. The diagonals are 1 in. x 5 in., held at each foot by two rivets. These triangulate each of the eight panels into which the frame is divided by the bolsters and the cross-tie at the center. The bolster, as shown in the cross-section, is unique, being attached to the sills in such a way that flange holes are avoided. A flat plate 15 in. wide and ½ in. thick is carried over the top of the center sills out to the webs of the side sills to which it is riveted. It runs back from the side sills to the 1-in. x 15-in. compression member to which the ends are riveted. In this way the thin plate serves as a tension member at the top, and a brace for the bottom of the side sills to hold them upright. The compression member passes beneath the center sills to which it, as well as the tension piece, is fastened by angles riveted to the webs, avoiding holes in the flanges. This piece has the center plate fastened to it. The end sills are of 1-in. x 10-in. plates protected against injury by heavy buffing timbers 10 in. thick at the front and 7 in. at the back.



Steel Tender Frame—Norfolk & Western Railway.



Plan and Sections of 5,000 Gallon Tender Tank—Norfolk & Western Railway.

The tank used on this frame has also been designed to be very strong and rigid. The thickness of the top, bottom, back and back corner sheets is ¼ in.; that of the side, front corner and coping sheets 5/16 in.; and that of those forming the coal space, sides and back 5/16 in. All angles are 2 in. x 2 in. x 5/16 in.; the tees are 3 in. x 3 in. x ⅜ in., and ½-in. rivets are used throughout. The stiffening tees for the side sheets are spaced 24 in. between centers, and upon each side there are three baffle plates to check the surging of the water, as indicated at A. The top is drained by the usual method of running a 1½-in. wrought-iron pipe down through the water space, held at the top by a flange riveted to the under side of the top sheet. Leakage at the bottom is prevented by rubber gaskets held between the sheet and the nuts on the pipe.

The Engine Inspector.

BY J. V. N. CHENEY.

At a gathering of a railroad association not long since among the questions discussed was the engine inspector—a creation deemed necessary where the pooling of engines is practiced. To be sure, there are times when the inspection of an engine—that is, thorough inspection—cannot very well be done by the engineman bringing it in, as in most cases the engine goes to the coal shed immediately on being cut off from the train, where it is left in charge of the hostler. He attends to the cleaning of the fires, sanding, etc., before the engine is put over a pit where a satisfactory inspection can be made. Or as is often the case the engine is ordered out even before arrival; then "she" waives examination. All this preliminary work of the hostler occupies considerable time, and the company is not willing to pay the engineman for all this time to obtain his personal inspection of the engine. Here is where the inspector comes in, and on his efficiency and thoroughness depends the economical and safe passage of the engine over the division. To be sure, there are some things that even the best inspector cannot discover while the engine is standing in the house, such as pounding rods and connections and driving boxes, blowing valves and pistons, the air pump that requires packing, etc., etc. These latter the engineman alone can be cognizant of and it should be his duty to report these defects.

There has been considerable discussion concerning the testing of valves, pistons, etc., in the engine house, but these are things that cannot be satisfactorily determined by such tests. I have before me a report of a test to determine this very point, whether the leakage was the same at all times, and the test showed conclusively that the leakage of these parts was not constant; that is, they would show a leak when standing, but when moving no appreciable leak or blow existed. A full description of the apparatus can be found in *Power*.

So much for blows. There seem to be, in various localities, differing ideas of what "inspector" means, his duties, etc. At one place I have in mind, the inspector was a bull-headed "Turk," who crawled into the pit with the monkey-wrench machinist's kit: hammer, chisel, and monkey-wrench. The apparent idea of inspector was a

the latter would be more competent to judge as to whether a defect discovered would safely make another trip without breaking down. Was there ever such a ridiculous proposition evolved by a presumably intelligent body of men? If a defect is discovered, why not make it right at once, not next trip. It will not cost any more to remedy it now than later; perhaps it will cost more next trip.

The ideal engine inspector is a sober, thoughtful man, one interested in his work, with a sense of its responsibilities and possibilities, not afraid to get a little dirt and grease on his hands and clothes, and above all, one who can, if necessary, do any work he may find needed to be done, and can supplement the engineman's inspection, or report, in the way of pounding rods, cross-heads, etc. For instance, an engineman reported a main-rod brass pounding and in his presence the machinist sent to do the necessary work drove the key over an inch each blow of the hammer, accompanied by remarks not necessary to repeat. An intelligent inspector looking over cases of this kind could very readily do what the machinist did with a saving of the time of the latter. In another instance an engineman reported driving boxes pounding, and engine riding hard. "No, it is not in the wedges, for me and Denny set them up with a wrench that long" (indicating). It took the machinist and helper with a wrench that much longer to pull the wedge down and free the driving box. This to show the kind of reports one runs up against.

Another argument of this body concerned the remuneration for a good inspector. I suggest that he be paid $100 a month the same as the traveling inspector. If one is worth it, the other is. A good man will save it to the company each month. Don't be stingy in such an important matter.

An Engineman's Life.

On September 1, Corning E. Goodwin, locomotive engineer on the Chicago & North Western Railway, was retired with a pension. For 39 years he has led a quiet uneventful life in the service of this corporation. But counting 39 years back brings us to 1864, the closing days of the civil war. When the war began in 1861, Goodwin, although a native of Lexington, Mass., had become a locomotive engineer on the Mobile & Ohio, and he was forced to run locomotives for the Confederates.

When General Beauregard came west after the battle of Bull Run, he planned a campaign into Kentucky. Goodwin took the train which carried General Beauregard and his staff from Jackson to Columbus Junction, and when they met the Union forces and defeat, the same engineer hauled them back. At the battle of Belmont the train was in the thickest of the fight and the enginemen laid pretty low. Back south they hauled the Confederate general and his men, in and out of the battle of Corinth; in and out of Pittsburg Landing.

Up and down the line the trains went with supplies, soldiers and sometimes a load of Union prisoners to the prisons farther south. Goodwin kept at this work until 1863, when the Confederacy had been compelled to abandon the lines, and had been forced as far south as Meridian, Miss. Leaving the Confederate service at Meridian, he started on a 75 mile walk back to Jackson, to his wife and infant daughter. The road and the woods were full of cotton burners, guerrillas, raiders and scout parties, but the engineer dodged them all and reached his home in safety.

General J. B. McPherson was now military engineer for the Federal army and Grant was encamped at Lagrange. To them Goodwin went, told his story, and 15 days after leaving Meridian, Miss., was engaged as an engineer over the same road he had become familiar with in the early days of the war.

The first train out of Jackson in the Federal service was hauled by Goodwin, when he carried McPherson and his soldiers to the relief of Corinth which the Confederates were trying to retake. Experiences in this campaign were similar to those of previous days; only 15 days had elapsed but the engineer was hauling Union soldiers, instead of Confederate troops, supplies and ammunition, and taking train loads of Confederate prisoners across the line into Kentucky, bringing back supplies and ammunition to Holly Springs, to Coffeeville and down towards the Gulf. Six times after he entered the Federal service he was warned by negroes of bridges burned, and at one time when just across the line in Kentucky he came to a halt in front of a cannon planted in the middle of the road with a company of Forest's cavalry at hand, but he reversed and succeeded in getting back and saving his train load of supplies.

Foreign Railroad Notes.

A German newspaper, for whose accuracy in this matter we shall not vouch, finds fault with the way in which the French have been building their railroad from the east coast of Madagascar to the interior. This is a very large island, with a large population, not African, but with a strong disinclination to work. For a considerable distance from the coast the country is one of the most unhealthy known, and the work if done at all must be done by acclimatized natives. These were taxed, and at such rates that they could not pay; but they were permitted to work out their taxes on the railroad, and in this way the services of natives have been secured for from two to nine months. Nevertheless, the railroad, which was opened for 18 miles near the end of last year, makes slow progress.

The hard times which set in in Germany in 1900 have not spared the State railroads; but in general these have not met the decrease in earnings with any very important reduction in expenses. An exception is in Saxony, where the State railroads in 1902 made "heroic" reductions in expenses very much in the American fashion after 1893. The aggregate reduction compared with 1901 was nearly 10 per cent. The expenditure for materials consumed in shops was reduced no less than 37 per cent., for rails for renewals nearly one-third, etc. The train service was but slightly reduced. There was no great reduction in the amount paid for wages. Most of the important employees have permanent engagements and their pay does not fluctuate but is established by law.

In Austria the owner of some woods through which a railroad passes sued for damage to his growing trees by reason of the smoke from the engines, and recovered.

Addition to Altoona Spring Shop.

A description of the spring plant of the Pennsylvania at Altoona and the special machinery it contained was published in the *Railroad Gazette*, Jan. 5, 1901. Since that time the demands of the road have increased to such an extent that it was found necessary to increase the facilities. This has been done by erecting a new building and duplicating the machinery in the older plant to double the output. The arrangement of the machinery in the new building is shown in Fig. 1. Nothing but plate springs are made.

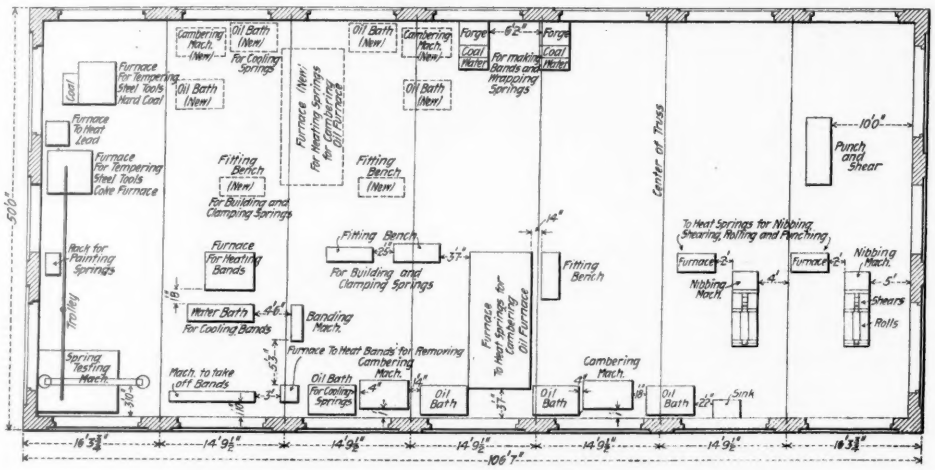


Fig. 1.—Arrangement of Machinery in Altoona Spring Shop.

The machinery is so arranged that the course of the material is progressive through the shop. It enters by the door or window at the right and is cut to lengths by the shears. It then goes to the furnaces for nibbing, shearing, rolling and punching and thence to the machines for performing these operations. The next step is to the cambering machine, after being heated in the oil furnace for same. This furnace is also fitted with a chamber for tempering the springs, which is heated by the waste from the regular heating compartment. This part of the machinery will be duplicated on the other side of the shop as shown by the dotted lines. After the leaves have been fitted and tempered the bands are put on and the springs are ready for painting and testing at the opposite end of the shop to which the material entered. The extra space that is at present available in this building is used for a small tool dressing plant. The power for driving all of the machinery is obtained from an electric motor set upon the roof trusses at one end of the shop.

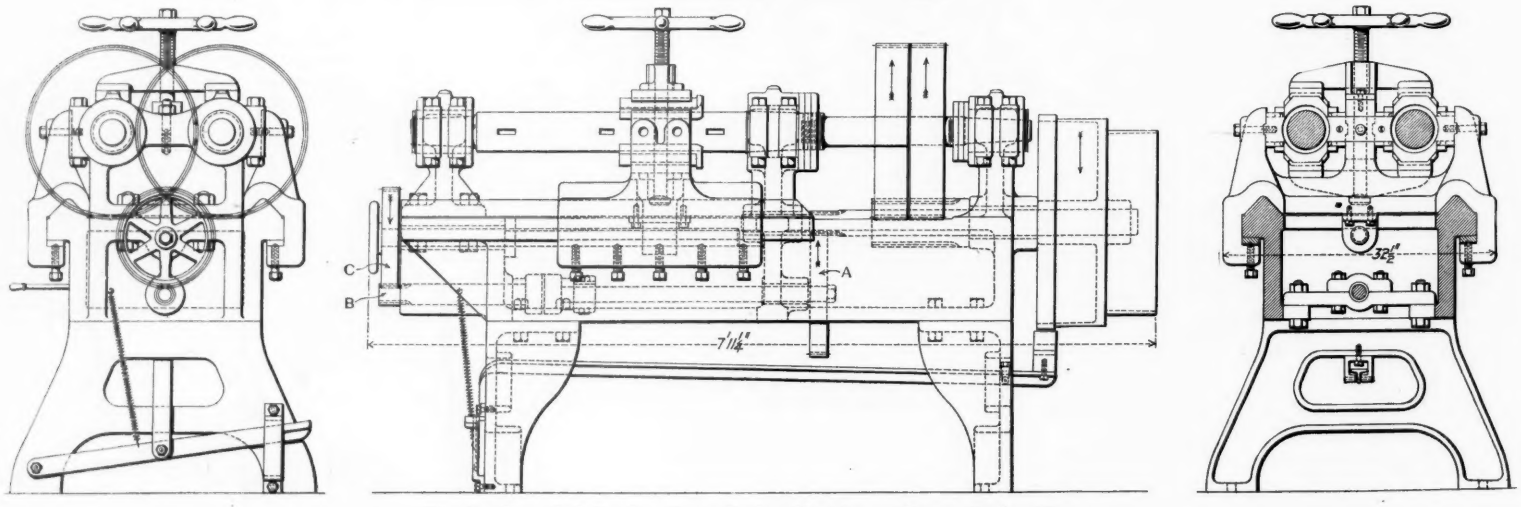


Fig. 2.—Two-Spindle Car Brass Boring Machine— Altoona Spring Shop.

Among the tools that have been designed and put into service in the brass shop is the two-spindle car brass boring machine shown in Fig. 2. Its speed and strength are such that it will bore the four brasses that can be held in its chuck in about seven minutes, taken as the average for the day. The bed, legs, carriage and boring bar are large and heavy and all moving parts are fitted with long bearings of ample diameter. Power is applied to the pulley at the right in the side elevation and transmitted to the two boring bars by a pinion and gearing. The feed is taken off from a pinion at the end of the pulley shaft

and the motion transmitted to the feed through the train of gears A, B and C, the latter being keyed to the feed screw.

The chuck is exceptionally strong and is arranged to clamp all four boxes with a single motion of the hand-wheel. The boxes are first laid upon the bottom dog of the chuck and upon the center stop at the side of the boring bar. The turning of the hand wheel then raises the lower dog and lowers the upper one in a way to catch all of them with the same pressure and at the same time.

To facilitate the handling of the work into and out of the machine there is a treadle by which a brake can be applied to stop it quickly.

TECHNICAL.

Manufacturing and Business.

The New York office of McCord & Company has been removed to 24 Broad street.

Walter L. Webb, C. E., has changed his address to 810 Girard Trust Building, Philadelphia, Pa.

The W. S. Carter Company, of Dover, has been incorporated in Delaware with a capital of $1,255,000, to build and operate railroads.

The firm of W. & A. C. Semple, Louisville, Ky., dealers in railroad supplies, has filed articles of incorporation, with a capital of $100,000.

The Algonquin Electric Brake Corporation, Portland, has been incorporated in Maine with a capital of $1,250,000. C. M. Drummond is President.

The Rochester sash lock has lately been ordered for the windows of new passenger cars for the Pittsburg & Lake Erie and the Kansas City, Mexico & Orient.

The Reliance Pneumatic Tool Company of St. Louis has been incorporated in Missouri, with a capital of $50,000, by W. D. Pittman, B. J. Buss, of St. Louis, and others.

The National Steel Castings Company, of Cleveland, has been incorporated in Delaware with a capital of $150,000, by H. Lindale Smith, J. R. McQuigg and W. B. Newcomb, Cleveland, Ohio.

The Motor Department of the Stanley Electric Manufacturing Co. of Pittsfield, Mass., will henceforth be in charge of Mr. A. W. Henshaw, formerly of the General Electric Company, Schenectady, N. Y.

The officers of the Railway Appliances Company are: President, C. F. Quincy, succeeding H. K. Gilbert, resigned; Vice-President, George H. Sargent, and Secretary and Treasurer, Percy Manchester.

Mr. Herbert F. Moore has been appointed Mechanical Engineer of the Riehle Brothers Testing Machine Company of Philadelphia. Mr. Moore was formerly instructor in machine designing at Cornell University.

The Western Steel Co., of Des Moines, Iowa, has been incorporated with a capital of $10,000 to operate water, light and power plants and build bridges and do other structural steel and iron work. Fremont Turner is interested.

The American Power Co., Minneapolis, Minn., has been incorporated with a capital of $600,000 to make motors and machinery. Joseph L. Michaels is President; L. S. Ovitt, Vice-President; F. E. Plummer, Secretary, and S. M. Moulton, Treasurer.

The Montauk Construction Company has been incorporated in New Jersey, with a capital stock of $125,000, to build and repair railroads, bridges, etc., by J. Nathaniel Gardner and J. E. Seeley, of 20 Broad street, New York City, and Thos. C. Allen, of Glassboro, N. J.

The general offices of the International Nickel Co., Orford Copper Co., Canadian Copper Co., Anglo-American Iron Co., Vermillion Mining Co. of Ontario, American Nickel Works, and Société Minière Calédonienne have been removed to 43 Exchange Place, New York City.

The Nix Rail Joint Company has been incorporated in Montana, with a capital of $100,000, to make the Nix rail joint. The headquarters will be at Miles City, Mont. The directors are Chas. F. Hogan, of Glendive; Wm. J. Nix and Wiseham W. D. Terrett, of Forsyth, Mont.

Harry A. Norton has returned from his trip to St. Petersburg, Russia, to which place he went early in the year to establish an agency for the sale of Norton jacks. Mr. Norton visited a number of other countries and reports that he was successful in securing some important orders.

A stock company will be formed, local reports say, with the name of the Fulton Pitt Car Company, for the purpose of taking over the Schrock Pitt Car Works of Canal Fulton, Ohio, which were recently bought by J. D. Evans, of Pittsburg, and Myers Bros., of Canal Fulton, for this purpose.

E. S. Woods, for a number of years Vice-President and General Manager of the Kindl Car Truck Company, has resigned to go into business for himself. He will introduce the Woods side bearings and other specialties. Mr. Woods' office will be in the Old Colony Building, Chicago.

The Gulf States Construction Company, New Orleans, La., has been chartered with a capital of $2,000,000 to build railroads, canals, bridges and to do other work, by John A. Lewis, of Meridian, Miss.; Chester H. Pond, of Moorehead, Miss.; Allen R. Beary, of New Orleans, and others.

The Speed Control Company, of Philadelphia, maker of the Simplex variable speed countershaft, has been sold to interests affiliated with the George V. Cresson Company, of Philadelphia. William H. Taylor will remain as General Manager and Chief Engineer. His office is in The Bourse.

The China Investment & Construction Company has been incorporated in New Jersey, with a capital stock of $1,000,000, to build railroads, street railways, and transportation lines. Albert W. Bash, W. Mons Greene and Chas. N. King, all of 243 Washington street, Jersey City, N. J., are incorporators.

The Federal Supply Company is equipping the cinder pits of the Northern Pacific with the Robertson automatic ash and cinder conveyor. This device has been in use on the Grand Trunk for several years. The Evansville & Terre Haute has also equipped its cinder pits at Evansville with the conveyor.

The United States Journal Packing Company has been incorporated in New Jersey, with a capital stock of $300,000, to make a patent elastic yarn ball for the packing of journals on railroad cars, etc., by Thomas D. Diehl, Wm. MacLean, Jr., and Joseph F. Cotter, all of 419 Market street, Camden, N. J.

Contract for the pumps and engines for the new filtration plant for Washington, D. C., has been let to the Worthington Company of New York, which will supply three centrifugal pumps, each capable of supplying 30,000 gal. of water a minute. The company will also supply the wash water pumps, which will be of the direct-acting type.

The roundhouses of the St. Louis & San Francisco have been equipped with cast iron smoke jacks, made by Paul Dickinson, 143 Fifth avenue, Chicago, at the following points: Vernon, Texas, 6 stalls; Bessie, Okla. T., 6 stalls; Enid, Okla. T., 10 stalls; Beaumont, Texas, 6 stalls; Wichita, Kan., 5 stalls; Brady, Texas, 6 stalls, and Hugo, Ind. T., 9 stalls.

Charles L. Allen, Secretary and General Manager of the Norton Emery Wheel Co., was presented with a loving cup by his employees on the occasion of his return from Europe, Oct. 7. A reception and an elaborate entertainment was given at the works at Barbers Crossing, Mass. The shops were decorated, and the 400 employees marched in a body to the room where Mr. Allen and the officers of the company were waiting.

James B. Bonner, for a long time with the Carnegie Steel Company, has been elected Manager of Sales of that company and other constituent companies of the United States Steel Corporation, and will assume charge of their interests in eastern Pennsylvania, southern New Jersey, Delaware, Maryland, Virginia and the District of Columbia. J. Ogden Hoffman, who formerly represented these interests, will be retained in an advisory position.

The National Steel & Wire Company will increase its capital from $5,000,000 to $10,000,000. The company makes rod and wire at New Haven, Conn., and De Kalb, Ill. M. L. Requa, of San Francisco, has been succeeded by Frank L. Brown as a director. The officers are: President, E. B. Webster, of Boston; Vice-President, E. F. Shellaberger, of De Kalb, Ill.; Secretary, H. Sanborn Smith, of New Haven, Conn., and Treasurer, E. R. Hastings, of Boston.

The directors of the American Car & Foundry Company at a recent meeting declared the regular quarterly dividend of 1¾ per cent. on the preferred stock, and 1 per cent. on the common, both payable Nov. 2. A statement gives the net earnings for four months ending Aug. 31 at $2,078,000, a decrease of $244,617 as compared with the corresponding period in 1902, when the net earnings were $2,322,617, but are in excess by $991,136 of the net earnings of 1901, which were $1,086,864.

At a meeting of the directors of the United States Steel Corporation Oct. 6, it was decided to pay the usual quarterly dividend of 1¾ per cent. on the preferred stock, and ½ per cent. on the common, the latter being only one-half the rate heretofore paid. A statement was also given for the nine months ending Sept. 30, which, compared with the previous period, shows a reduction for each month, with the exception of February, June and July. In September the loss was heavy, the total decrease in net being $7,128,322.

At the meeting of stockholders of the Westinghouse Air Brake Co., held Oct. 6, President George Westinghouse announced that the Canadian Westinghouse Co., a new corporation with a capital of $2,500,000, will take over all the Westinghouse interests in the Dominion. The transfer was approved. It is proposed to have the air-brake company dispose of its Westinghouse Manufacturing Co., Limited, of Hamilton, Ont., to the new company. The $650,000 stock of the older company is to be exchanged for stock of the new company, and the W. A. B. Co. is to underwrite $200,000 in stock in the new company for Canada. The Westinghouse Electric & Manufacturing Co. will also take stock of the new Canadian company, and sell to it its business rights and patents.

The East St. Louis Locomotive & Machine Shop Company has purchased a machine shop at East St. Louis, Ill., which will be used exclusively for repairing locomotives. The shop is on a 4½ acre lot adjoining the Southern Railway, and is about 100 ft. wide and 200 ft. long, accommodating six locomotives for repairs at one time. Among other modern tools the shop contains two Niles Tool Works Company's lathes, two Niles Tool Works Company's drill presses, and American Tool Works Company's planer and an Ingersoll-Sergeant air compressor. Chicago pneumatic tools are used. The company is prepared to do all classes of locomotive work including complete rebuilding. It also buys and sells locomotives and does a general machine shop business. It has just completed a two-story office building and is making plans for the erection of other shops.

Iron and Steel.

It is reported that F. de J. Villareal, of Monclova, State of Coahuila, Mexico, is about to place a contract for 400 tons of 25 to 30 lb. rails.

In accordance with its system of centralization, the American Tin Plate Company will move its plant from Niles, Ohio, to Sharon, Pa.

The Wilkes Sheet Rolling Mill, Sharon, Pa., has resumed operation in all its departments after being closed several weeks for repairs. Orders have been booked ahead for several months.

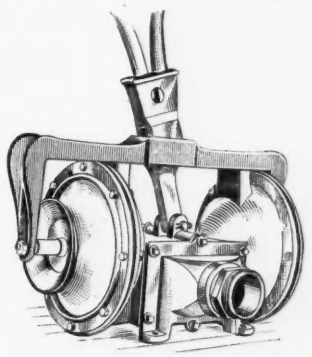
A new company known as the Hart Steel Company has been organized to market the Hart tie plates for railroads, which are being made by the Diamond State Steel Company of Wilmington, Del. L. B. Thornburgh, 135 Broadway, New York city, is interested.

The Denver Steel Castings Company, Denver, Colo., expects to build a steel castings foundry to have a capacity of 80 tons a day. The company will build a foundry 250 ft. x 130 ft.; a brick power house, 150 ft. x 45 ft., and office buildings, pattern and other shops.

The Standard Machinery Company has been organized by John T. Maguire, of Pawtucket; Michael J. Houlihan, of Providence, and others as incorporators, with a capital of $100,000 for the purpose of taking over the business, bought a short time ago from the receiver, of the Mossburg & Granville Mfg. Co. at Providence, R. I.

A New Design of Diaphragm Pump.

The engraving shows a new design of double-acting hand-power diaphragm pump. It is intended for use by sewer contractors, foundation and bridge builders, waterworks, sewer departments and sanitary works. It is claimed to be highly efficient, its peculiar construction making it frictionless and non-chokable. Among the many advantages claimed for it are the following: Its large capacity —2 gal. per stroke—enables it to deliver an almost continuous 3-in. stream; it is light, weighing only 163 lbs.,



and can be transported with ease; it can be used either as a suction or as a suction and force pump; neither sand, gravel, nor mud can clog the valves; as a result of its double action the water is kept continually in motion, saving the extra power needed to stop and start the flow; the pump can be placed anywhere on the work and the water discharged over a bank, wall, or any other obstruction; the inlet and outlet connections are made with hose couplings, enabling the pump to be placed anywhere inside of a building and the water discharged into the street or sewer without leakage at the pump. It is made by the Boston & Lockport Block Company, Boston, Mass.

The Cyclopean Concrete Bucket.

The accompanying engraving shows an improved bucket for handling concrete which has been perfected by men

having practical experience in concrete construction work. A difficulty with the buckets commonly used is that they must be inverted to empty them and the load

is usually permitted to drop in a solid mass, often jarring and distorting the forms and disturbing to a harmful degree the concrete already placed. The improved design is hopper-shaped and discharges through the bottom. When a load of concrete is to be deposited, the bucket is brought immediately over, and close to the spot, and when the bottom is opened the concrete flows out instead of dropping in a lump. Also, this avoids the usual side or back swing following the discharge of the old-style bucket, which often results in damage to the forms.

The Cyclopean bucket is made of No. 10 sheet steel and the bottom is released by an automatic catch which has a safety device to guard against accidents. The bucket dumps instantly without splash or loss of material. It is made in ½, 1 and 1½-cu. yd. sizes, or larger, by Jones & Harold, proprietors of the Cyclopean Iron Works, Jersey City, N. J.

Interlocking.

The New York Central has awarded the contract to the Pneumatic Signal Company, of Rochester and New York, for building and erecting the interlocking plant at East Buffalo, which was mentioned in the *Railroad Gazette* of August 28. This interlocking (Towers 47 and 47 A) will be low-pressure pneumatic, and 106 levers will be required.

The State Railroad Commissioners of Mississippi have given authority for the installation of interlocking at crossings of the Natchez, Columbia & Mobile at Norfield and the Liberty White Railroad at McComb City.

THE SCRAP HEAP.

Notes.

Indiana newspapers say that the electric roads in that State are already making contracts with the steam railroads for through excursion tickets to St. Louis next year. The management of the Union Traction Lines is said to have made an arrangement with the Toledo, St. Louis & Western.

On the New York division of the Philadelphia & Reading, passenger brakemen have been instructed to carry cotton waste in their pockets and to wipe off the hand rails of the passenger cars just before stopping at stations.

Press despatches from Louisville, Ky., say that the Louisville & Nashville has dismissed from the freight department 40 clerks "for joining a union." A man from Kansas City lately organized a union in Louisville, and it is said that 400 clerks joined it.

At Aurora, Ill., on the night of October 8, three highwaymen stopped an electric car and robbed the motorman and conductor. Police were called and attacked the highwaymen; and in the contest which ensued one of the robbers was killed and another wounded.

According to the daily newspapers, the New York Central and the Erie roads are making investigations of the records of their employees looking to the adoption, at some time in the future, of a pension system, like that in force on the Pennsylvania and other roads.

A press despatch from New Orleans says that on Monday last a special train of the Illinois Central, carrying the general passenger agents to their annual convention in that city, ran 105 miles in 90 minutes, including stops, and that a speed indicator in one of the cars registered as high as 94.4 miles an hour at some places. One stretch of 13 miles is said to have been traversed in 10 min.

The express companies of Texas, as was expected, entered suit in the United States Court to enjoin the State Railroad Commissioners from ordering reductions in their rates, and the suit is to be heard at the January term. Railroad Commissioner Colquitt says that the Commission will contest the point to the court of last resort, as it is a question of the life or death of the Railroad Commission.

According to the New York daily newspapers, the locomotive engineers on the Interborough (Manhattan) Elevated Railroad are preparing to make strenuous objection against a recent order requiring the men to undergo physical examinations. These men are members of the Brotherhood of Locomotive Engineers, though most, or all, of them are now running electric motors, with no fireman. The examination will cover particularly sight, hearing and condition of the heart. The reporters do not mention any reason for the present attitude of the men, though some of the enginemen seem to think that the examination is to disguise a weeding-out process. Some of them say that all of them were examined only a year or two ago.

The New York Central, the Lake Shore, and other affiliated lines, and also the Erie and the Southern Pacific, have within the last week or two dismissed considerable numbers of men from their car and locomotive shops. This reduction of forces, coming at the time when track repair forces are also reduced, leads the newspapers to print long statements, with speculation about the possible effect on the general business of the country. An officer of one of the roads says that a reduction in the iron and steel industries appears to be coming soon, and that this reduction of expenses by the railroads is made in anticipation of a shrinkage of traffic in iron and other commodities. Producers of pig iron appear to have agreed on a reduction of 25 per cent. in the output of their furnaces. All of the roads say that their freight cars are now in good condition, justifying a reduction of the repair forces.

Grand Trunk Car Ferry.

The Grand Trunk now carries freight cars across Lake Michigan, between Grand Haven and Milwaukee, a boat being in service which takes on 20 cars. It makes three trips daily. The regular steamers run as before, carrying passengers and package freight.

Forty-Year Review of Freight Tariffs.

The Interstate Commerce Commission has issued a report, prepared by the auditor of the Commission, entitled "A Forty-Year Review of Changes in Freight Tariffs." The data in this review, which mostly consists of tabular matter, are grouped under the heads of (1) Development of Freight Classifications; (2) Changes in Competitive Rates, and (3) Changes in Local Rates. Each of the 164 tables shows the changes from the earliest date from which it was practicable to obtain satisfactory records.

International Waterways Commission.

The President has appointed Col. O. H. Ernst, Corps of Engineers, U. S. A.; Prof. G. S. Williams, of Cornell University, and Mr. George Clinton, of Buffalo, N. Y., as the representatives of the United States on the International Commission to investigate the question of water routes from the Great Lakes to the Atlantic Ocean, and upon the maintenance and regulation of lake levels. This action was authorized by the river and harbor Act of 1902 under which the President has invited Great Britain to join in forming an International Commission. Great Britain has accepted the invitation and will soon appoint its representatives.

The New Station at Washington.

It is announced from Philadelphia that the Pennsylvania Railroad will itself build the new Union station at Washington, under the direction of W. H. Brown, Chief Engineer, and D. H. Burnham, of Chicago. The work will be superintended by Roydhouse, Arey & Co., of Philadelphia. The bids recently received for the work, about 50 in all, ranged from about $4,000,000, the minimum cost fixed by the Act of Congress authorizing the work, to $6,000,000. From sub-bids received from contractors, it is found that the company can build the station for about $4,250,000, which will include the cost of white marble for the exterior, if it is decided to use marble. Exclusive of the train shed the station will cover an area 750 by 250 ft. The train floor is to be 800 by 135 ft. and the main waiting room will be 200 by 250 ft. About three years will be required to complete the work.

Railroads in Uruguay.

The republic of Uruguay, which is just north of the Argentine Republic, across the Rio de la Plata—there a bay rather than a river—with an area of 69,000 square miles (equal to the State of Missouri) and 900,000 inhabitants has 998 miles of railroad which have cost $50,739 per mile. The railroads were built by English companies, with a government guarantee of interest for about two-thirds of the mileage. The guarantee was originally of 7 per cent., but this was reduced to 3½ per cent. in 1891. The yearly amount guaranteed is $945,635, of which in 1899, the last year reported, the railroads themselves provided only $128,238. In that year gross earnings were $2,410 per mile, 62 per cent. of which was required for working expenses, leaving $916 net, which is 1.8 per cent. on the cost. Lines projected and in part under way amount to 1,213 miles. Uruguay lies between latitude 30 deg. and 35 deg. south, corresponding to the position of Georgia, but probably with a somewhat lower temperature. A navigable river forms its western boundary, and the great La Plata is on the south. It remains chiefly a grazing country.

English Railroad Men's Working Hours.

The British Board of Trade has issued its tenth annual report (to July 27, 1903), of its doings under the law of 1893, regulating the hours of labor of railroad employees. The year of this report always ends on July 27. The memoranda of the cases dealt with during the past year fill about 18 pages. There is a great deal of sameness in them as, indeed, has been observable in preceding years. A complaint is made that certain enginemen or trainmen have to work long hours; the Board of Trade, if it finds the complaint well founded, asks the company to submit a revised schedule; the company, after a time, does so; and in a considerable portion of the cases still fails to fully meet the views of the Board of Trade, and the Board renews its pressure by correspondence. On the other hand, a considerable sprinkling of the cases are found unworthy of prosecution.

The total number of new cases inquired into during the year now reported on was 28, as against 123 the year before, 19 in 1901 and 40 or 50 in each of the three years before that. The Board is confirmed in its view that ground for complaint, where it exists, does not usually arise from excessive booked hours, but from failure to keep the actual working hours down to the schedule.

Pilgrims and Gross Earnings.

The Damascus & Mecca Railroad, designed almost exclusively to carry pilgrims to Mecca and Medina, has made greater progress than was expected by the infidels, who were inclined to sneer at it when it was begun, three years ago. A German newspaper in Constantinople says that the rails are down for 230 miles, and that 252 bridges (there is scarcely any water in the country), a tunnel and several stations have been built, and 18 locomotives and 173 cars procured; while the contributions of the faithful exceed the expenditures so far made by nearly 80 per cent. Not one-third of the line is built yet, however; and the difficulties are such that religious zeal is needed to overcome them. Nearly the whole line is through a desert, and the wandering Bedouins who pasture their camels and sheep in it, though faithful themselves, put all kinds of obstacles in the way. One of their chief sources of income is the caravan traffic, and they object to the competition of the locomotive. Scarcely any traffic except the pilgrim travel is expected or seems possible, and this is confined chiefly to one month of the year; and as most of the pilgrims are extremely poor, they must be carried at very low rates: many, probably without any charge. It is a purely religious undertaking, and must not be judged as if it were intended to make money.

Japanese Railroads.

The Japanese railroads March 31, 1902, had a total length of 4,026 miles, of which 1,060 were State railroads. They had 1,350 locomotives, 4,529 passenger and baggage cars, and 19,774 freight cars, and had cost $151,700,000. The traffic for the year then ending, on an average of 3,964 miles worked, was 1,899 millions of passenger-miles and 791 millions of ton-miles, which is equivalent to the movement each way daily of 656 passengers and 273 tons of freight. This may be compared with the daily movement in this country in 1891-'02 of 135 passengers and 1,049 tons of freight. The density of the passenger traffic was thus nearly five times as great in Japan as here; and the density of the freight traffic nearly four times as great here as there. We should remember here that Japan had 11,700 inhabitants per mile of railroad; the United States not more than 395. The average journey in Japan was 17 miles; the average fare per mile, ¾ cent; the average freight haul, 55 miles; the average rate, 1 cent per ton-mile.

The average earnings of the Japanese railroads were $6,305 gross and $3,039 net per mile. Per train-mile gross earnings were but 80 cents, but expenses were only 39 cents, and this made the net 8.2 per cent. on the cost of the railroads. One of the State railroads earned 14.2 per cent. on its cost, and one of the private railroads (which, however, is only 27 miles long) earned 16.6 per cent.

Disastrous Floods in New York and New Jersey.

On October 9, 10 and 11, enormous damage was caused by heavy floods in southeastern New York, northern New Jersey and the Delaware River Valley, the losses at Paterson, N. J., being estimated at $3,000,000, and at Passaic $2,000,000. Many manufacturing interests suffered and hundreds of families were driven from their homes. Along the Delaware River the principal damage was confined to bridges, commencing at Deposit. Nearly every highway bridge between Easton and Trenton, including those at Reigelsville, Frenchtown, Milford, Lambertville, Washington Crossing and Yardley, were swept away. Most or all of these bridges were covered wooden structures many years old. The Delaware seems to have risen higher than ever before. Several bridges on the Ulster & Delaware railroad between East Meredith and Phœnicia were carried away and train service was stopped several days. At Catskill, N. Y., a bridge was broken down by a barge running into it, and two persons were drowned. The suspension bridge below the village of Deposit, N. Y., was carried away. At Port Jervis Barratt's 651 ft. suspension bridge over the Delaware to Matamoras, Pa., was carried away. The Neversink Light & Power Company's dam, which supplied Port Jervis and Middletown with light and power, broke and was destroyed. The large dam at Pompton Lakes, N. J., gave way, the flood carrying down the iron bridge over the Ramapo River below the dam. The Erie Railroad, main line, was blocked five days or more by washouts between Paterson and Middletown. The main line of the Pennsylvania was blocked at Trenton for 24 hours or more, by high water which backed up from the Delaware in one of its tributaries.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular mettings of railroad associations and engineering societies see advertising page xvi.)

The Brooklyn Engineers' Club.

The Brooklyn Engineers' Club held the first meeting of the season on the evening of October 8. Besides the usual formal business, an interesting paper, entitled "A History of Pumps, Ancient and Modern," was read by Mr. John A. Drew, of the Worthington Company. Mr. Drew sketched the development of pumping machines from the early Egyptian "Noria," resembling the familiar well sweep, to the latest triple-expansion, condensing, waterworks pumping engines, requiring little more than a pound of coal per horse-power-hour. The paper was illustrated by lantern slides.

Iron and Steel Institute, New York Meeting.

The Iron and Steel Institute, of Great Britain, has decided to hold its next year's convention in New York City on October 24-26, 1904. Mr. Andrew Carnegie is president of the Institute and the action is taken in acceptance of a formal invitation by the American members, endorsed by the American societies of Electric, Mechanical and Mining Engineers and the American Foundrymen's Association. After the meeting excursions are arranged for to Philadelphia, Washington, Pittsburg, Cleveland, Niagara Falls, Buffalo and Chicago, and to the St. Louis Exhibition.

Pacific Northwest Society of Engineers.

The Pacific Northwest Society of Engineers held its regular monthly meeting at Seattle October 3. The meeting was presided over by R. H. Thomson, President, and two papers were read on "The Development of the Pacific Coast Company's Properties," by F. H. Whitworth and James Anderson. Mr. Whitworth's paper dealt with the opening and development of the coal mines and the construction of railroads to transport the coal from the mines to Seattle. Mr. Anderson dealt with the enlargement of the mines, the reconstruction of the railroads, and the building of docks on the Pacific coast from Alaska to Mexico.

General Passenger Agents.

The 48th annual convention of the American Association of General Passenger and Ticket Agents was held at New Orleans this week. The President of the Association, Mr. O. W. Ruggles, was kept at home by the illness of his mother and Vice-President Frank I. Whitney (Great Northern) occupied the chair. The committee on anti-scalping legislation was discharged, its work being now taken care of by the Protective Bureau. The President, the Secretary and the executive committee were made a committee to consider applications of printers who wish to use the association's safety paper. Besides the regular address, which was by Mr. W. J. Lynch, of the Big Four, there was an address by Mr. L. W. Landman, Secretary of the Traveling Passenger Agents' Association, which association had been invited to send a representative. Mr. Dearing, of the Michigan Central, made a report on the baggage department in which he said that the baggage department offers the least inducement to men wishing to advance in railroad life. Employees in it are poorly paid for the work done, and there is no chance for promotion. Inferior facilities for the handling of baggage compel the employment of a large force for which there is no use between trains. Too much baggage of excessive weight is carried on passenger trains and a further handicap is the lack of space in baggage cars. Coaches and engines increase in size and so should these cars, instead of dividing their space for buffet accommodations.

Vice-President Whitney was elected President for the ensuing year, and F. E. Boothby, of the Maine Central, was elected Vice-President. Secretary A. J. Smith (L. S. & M. S.), Cleveland, Ohio, was re-elected Secretary.

Mr. Lynch in his address said: "An occupation coupled with a mission, an occupation affording an opportunity to do good, an occupation affording an opportunity to cater to the pleasures and comfort of our fellowmen must and always will be attractive to men of large hearts and generous impulses. And in such occupations will always be found men who will devote their lives and their talents to the service and find their reward as much in a duty well done as in any temporal advancement. They may not accumulate great fortunes or endow colleges or asylums, but they will have the satisfaction of having said of them while living what is withheld from most men until it is carved in marble over their last resting place."

PERSONAL.

—Mr. John F. Richardson, District Superintendent of the Pullman Company, died at his home in Omaha, Neb., on Oct. 11. Mr. Richardson was born at Otis, Mass., in 1858, and has been with the Pullman Company since 1882, beginning in that year as a conductor. From 1884 to 1887 he was agent and since the latter date (1887) has been a District Superintendent.

—Mr. G. V. Peyton, the new Assistant Superintendent of the Southern Railway at Greensboro, N. C., began railroad service at the age of nine years, starting as an operator on the Virginia Midland, now the Washington Division of the Southern. Mr. Peyton has been with this company ever since. In 1892 he was appointed despatcher, and six years later was made Chief Despatcher at Greensboro. In 1900 he was promoted to be Trainmaster, from which position he is now promoted to that of Assistant Superintendent at that point.

—Mr. Thomas Gucker, who for a number of years was Superintendent of the Philadelphia Division of the Pennsylvania Railroad, died at his home in Philadelphia, Pa., on Oct. 7. Mr. Gucker was born in Williamsport, Pa., in 1844, and entered railroad service in 1862 as a messenger in the office of the Superintendent of the Eastern Division of the Philadelphia & Erie. In 1873 he was made Superintendent of that Division, and in 1883 became Superintendent of the Philadelphia Division of the Pennsylvania, from which position ill health compelled him to resign a few months ago.

ELECTIONS AND APPOINTMENTS.

Central of Georgia.—R. C. Smith and G. A. Blair have been elected Directors. Mr. Smith succeeds E. T. Comer, resigned.

Chicago, Rock Island & Pacific.—Charles A. Goodnow, General Manager, has resigned, and John F. Stevens, Fourth Vice-President, will, until further notice, have charge of the operating and construction departments. B. L. Winchell, Vice-President and General Manager of the St. Louis & San Francisco, has been appointed Third Vice-President of the Chicago, Rock Island & Pacific, the Choctaw, Oklahoma & Gulf, and the St. Louis, Kansas City & Colorado, with headquarters at Chicago; effective Oct. 15. C. H. Warren, First Vice-President, and Robert Mather, Second Vice-President and General Counsel, are to move their offices from Chicago to New York. A circular from President W. B. Leeds announcing the removal of Messrs. Warren and Mather to New York says that Mr. Winchell is to be the chief executive officer of the company in the west, and he will also have special charge of the development of the commercial interests of the Rock Island system. C. J. Wilson, hitherto Superintendent of the Northern Pacific at Jamestown, N. Dak., has been appointed Superintendent of the Nebraska Division of the C., R. I. & P., with headquarters at Fairbury, Neb., succeeding C. L. Nichols, resigned.

J. R. Blair, Superintendent of Terminals, has been appointed Superintendent of the Kansas City Terminal Division. This division includes the territory west of the Missouri River and the Rock Island junction.

Cincinnati, Hamilton & Dayton.—J. B. Foraker has been elected a Director, succeeding the late R. C. Schenck.

Grand Trunk.—J. Devine has been appointed Assistant to the Superintendent at Allandale, Ont., succeeding L. G. Coleman, transferred.

Indiana, Illinois & Iowa.—See Lake Shore & Michigan Southern below.

Lake Erie, Alliance & Wheeling.—See Lake Shore & Michigan Southern below.

Lake Erie & Western.—H. A. Boomer has been appointed Assistant General Superintendent, with headquarters at Indianapolis, Ind., succeeding D. C. Moon, resigned, to go to the Lake Shore. T. F. Bowles has been appointed Superintendent of the Peoria Division, with headquarters at Lafayette, Ind., succeeding Mr. Boomer, and Mr. Bowles in turn is succeeded by W. J. Davis as Superintendent of the Fort Wayne, Cincinnati & Louisville Division, with headquarters at Muncie, Ind.

Lake Shore & Michigan Southern.—D. C. Moon, hitherto Assistant General Superintendent of the Lake Erie & Western, has been appointed Assistant General Superintendent of this company, the Indiana, Illinois & Iowa, and the Lake Erie, Alliance & Wheeling, with headquarters at Cleveland, Ohio, effective Oct. 10.

Louisville & Atlantic.—J. J. Flynn has been appointed Master Mechanic, with headquarters at Richmond, Ky., succeeding Louis Wellisch, resigned.

Northern Pacific.—A. M. Burt, hitherto Assistant Superintendent at Grand Forks, N. Dak., has been appointed Superintendent, with headquarters at Jamestown, N. Dak., succeeding C. J. Wilson, resigned.
See Chicago, Rock Island & Pacific.

Queen Anne's.—Charles Neilson, Vice-President and General Manager, with headquarters at Baltimore, Md., has resigned.

Rio Grande Southern.—W. D. Lee, Superintendent, with headquarters at Ridgway, Colo., has resigned. (See Santa Fe Central.)

St. Louis & San Francisco.—See Chicago, Rock Island & Pacific.

St. Louis, Iron Mountain & Southern.—W. C. Hurst has been appointed Assistant Superintendent of the Illinois Division, with headquarters at Chester, Ill., succeeding J. S. McGuigan, transferred.

Santa Fe Central.—W. D. Lee, hitherto Superintendent of the Rio Grande Southern, has been appointed General Manager of the S. F. C., with headquarters at Santa Fe, N. Mex., succeeding W. S. Hopewell, resigned.

Union Pacific.—R. W. Baxter, Division Superintendent, with headquarters at Omaha, Neb., has resigned.

LOCOMOTIVE BUILDING.

The Lorain Steel Company is having one locomotive built at the Baldwin Works.

The Ferro Carril de Brazil is having eight locomotives built at the Baldwin Works.

The Hocking Valley has ordered 10 locomotives from the American Locomotive Co.

The Missouri Pacific has ordered 35 locomotives from the American Locomotive Co.

CAR BUILDING.

The Louisville & Nashville is in the market for 1,000 cars.

The Long Island is in the market for 200 cars.

The Tennessee Central is in the market for 600 cars.

The American Car & Foundry Co. has miscellaneous orders for 29 cars.

The Brooklyn Rapid Transit is in the market for 100 cars for elevated service.

The Pittsburg, Shawmut & Northern are asking bids on 200 box and 50 coke cars.

The Chicago, Cincinnati & Louisville is reported to be in the market for a number of cars.

The Turner-Hudnut Co., Pekin, Ill., have ordered five box cars from the Middletown Car Works.

The Cumberland Valley will build five vestibule coaches and four baggage and express cars at its Chambersburg shop.

The Missouri Pacific is having five coaches built at the Wilmington Works of the American Car & Foundry Company.

The Cuba Eastern is having 40 freights built by the Bloomsburg Car & Foundry Co., Bloomsburg, Pa. (American Car & Foundry Company.)

The Richmond, Fredericksburg & Potomac has ordered two passenger coaches, two express cars and one combination mail and baggage car from the American Car & Foundry Company.

The Cold Blast Transportation Company, Chicago, as reported in our issue of Oct. 9, has ordered 100 refrigerator cars from the American Car & Foundry Company. These cars will be built at the Chicago Works.

The Atlantic Coast Line will build 500 60,000-lb. flat cars at its shops at Wilmington, N. C. Among the equipment specified are American Steel Foundry Company's bolsters, Thornburgh coupler attachments, Pittsburg Steel Spring Company's springs, and Paul S. Reeves brasses.

The Midland Valley is having 250 coal cars of 80,000 lbs. capacity, and 25 flat cars of 60,000 lbs. capacity built by the Mt. Vernon Car Mfg. Co. Special equipment for both includes Westinghouse brakes, Ajax journal bearings, Pittsburg Steel Spring Company's springs, Mt. Vernon Car Mfg. Co.'s wheels, and for the coal cars Tower couplers and Simplex body and truck bolsters.

The Terre Haute & Indianapolis has increased the number of cabooses ordered from the American Car & Foundry Co. from eight to nine. The cars will be 29 ft. 6 in. long, 8 ft. 6 in. wide and 7 ft. 1 in. high, with wooden frames and underframes. Special equipment includes Tower couplers, hand-brakes, gray iron brake-shoes, Pennsylvania R. R. specification axles, brasses, paint and springs, canvas roofs, Graham draft rigging and American Car & Foundry Co.'s wheels.

The Mount Vernon Car Mfg. Co. is building the following equipment: Peoples Cotton Oil Co., five box cars; Meridian Fertilizer Works, five box cars; Southern Ry., 33 box car bodies; Chicago, Rock Island & Pacific, 50 cabooses; Chicago & Eastern Illinois, 20 cabooses; Kentucky Refining Co., two barrel cars; Midland Valley, two cabooses, and the Wabash, Chester & Western, 15 coal cars of 60,000 lbs. capacity, equipped with Westinghouse brakes and cast steel automatic couplers.

BRIDGE BUILDING.

ALLIANCE, PA.—The County Commissioners have approved the building of a bridge over the Catasauqua Creek in East Allen Township.

BOSTON, MASS.—Bids are wanted Oct. 19 by the Metropolitan Park Commission for some bridge abutments and grading Revere Beach breakway from Main street, Everett, to Fellsway, Medford.

BRAINERD, MINN.—Bids are being received by A. Mahlum, Crow Wing County Auditor, for the building of a steel bridge over the Mississippi River in Perry Township.

BUFFALO, N. Y.—The Erie, it is reported, will build a viaduct over its tracks at Perry street.

COLOGNE, N. J.—Bids are being asked by Frank Enderlin, chairman of the committee of bridges of Atlantic County, for a new bridge over Cordrey's Run at the new county road.

COCKEYSVILLE, MD.—The county and the Northern Central will jointly build a bridge over the railroad tracks of the Northern Central.

DAYTON, OHIO.—Bids will be received Oct. 24 by Edward Phillips, City Auditor, for the sale of $220,000 city bonds, the proceeds of which are to be used in building the Third street bridge over the Miami River and for the necessary land.

DERBY, CONN.—Bids received for building a steel bridge over the Naugatuck River have been rejected and new ones may be asked for. (Aug. 14, p. 593.)

DES MOINES, IOWA.—New bids may soon be asked for the iron bridge at East Sixth street, those received Sept. 22 having been rejected as exceeding the funds available. The bids received were from the Geo. E. King Bridge Company of Des Moines, Iowa, $66,487; Clinton Bridge & Iron Works, Clinton, Iowa, $67,200; N. M. Stark & Co., $67,200; J. F. Griffith & Co., $67,350; Midland Bridge Company, Kansas City, Mo., $67,800; Marsh Bridge Company, Des Moines, Iowa, $68,130; Canton Bridge Company, Canton, Ohio, $70,200; Iowa Bridge Company, $71,100; Minneapolis Steel & Machine Company, $73,100. John W. Budd is the City Engineer. (Sept. 11, p. 659.)

FRESNO, CAL.—A contract, it is reported, has been let to the Pacific Construction Co., San Francisco, for building the Herndon bridge, at $33,983.

GREEN BAY, WIS.—A bridge may be built by the city over East River to cost $10,000.

HARLAN, IOWA.—Bids may soon be asked by the County Auditor for two steel bridges in Shelby County.

HOUSTON, TEXAS.—The plans now preparing for a bridge over Buffalo Bayou will call for a lift or swing bridge of two spans of 100 ft. each and 40 ft. wide, to cost about $50,000.

KOKOMO, IND.—A bridge may be built jointly by Howard County and the Union Traction Company, at Union street, to cost about $12,000.

LEAVENWORTH, KAN.—Bids may soon be asked by the County Commissioners for bridges over the Kaw River at an aggregate cost of $30,000.

LOWELL, MASS.—A bridge may be built by the city over Beaver Brook, at New York street, to cost about $27,000.

MARCY, N. Y.—The question of building a bridge over the Mohawk River to replace the Bowstring bridge is under consideration. The town board will ask the city of Utica to share the expense.

MAYODAN, N. C.—Bids are wanted Oct. 17 by the Board of County Commissioners of Rockingham County for the building of an iron bridge over Mayo River. J. A. Scales, Clerk.

MONROE, LA.—The Police Jury of Ouachita Parish will ask for a vote on a tax to run for 10 years which will net about $1,250,000, the proceeds to be used in building 19 steel bridges and six trestles.

MONTALVO, CAL.—The Southern Pacific may build a steel bridge over the Santa Clara River.

MYSTIC, CONN.—A bridge may be built over the Mystic River to cost about $500,000 by the local electric railroads.

NEW CASTLE, PA.—The Chamber of Commerce at a recent meeting considered the question of viaducts and overhead bridges to replace present grade crossings.

PARKERSBURG, W. VA.—The City Council is considering the building of a bridge 220 ft. long, 20 ft. wide and 28 ft. high. Bonds will be voted on this month. The long delay has been caused by difficulty in deciding whether to build a steel viaduct or stone arch. J. V. Dunbar, City Engineer.

PITTSFIELD, MASS.—The Board of Public Works, it is reported, has plans for a steel bridge to be built over the Housatonic River, for which bids may be asked next month.

RICHMOND, VA.—The Virginia Passenger & Power Company, it is reported, has completed surveys and will build the bridge over James River as soon as the necessary privileges are granted.

ROGERS, ARK.—Benton County Levy Court is raising $12,000 and the township will contribute $1,000, the proceeds to be used in building a State bridge over White River.

ST. JOSEPH, MO.—Bids are wanted Oct. 26 by Theo. Steinacker, County Surveyor, Buchanan County, for repairs to 10 bridges and the building of two bridges in that county.

ST. PAUL, MINN.—Bids are being received by G. T. Redington, City Clerk, for the rebuilding of the bridge over Happy Hollow.

ST. PETER, MINN.—Lesueur and Nicollet Counties have under consideration the building jointly a 200-ft. double track steel bridge, with stone piers, over the Minnesota River, to cost about $14,000.

SPOKANE, WASH.—The City Council has accepted Engineer Gill's plans for a new combination iron and steel bridge over Hangman Creek to cost $60,000.

TOPEKA, KAN.—All bids have been rejected and new ones may soon be asked by the Shawnee County Commissioners for rebuilding the Grantville bridge.

TORONTO, ONT.—The railway committee of the Privy Council has decided that a bridge must be built at Yonge street over the railroad tracks, to be paid for jointly by the Grand Trunk and the Canadian Pacific.

TORREON, MEXICO.—The large bridge over the Nazas River, on the Mexican Central, near this place, was washed away by a recent flood in that stream.

Other Structures.

ATLANTA, GA.—The Atlanta Terminal Company, local reports say, has awarded the contract to Gude & Walker, of Atlanta, to build the new passenger station at a cost of about $405,000.

BEAUMONT, TEXAS.—The new freight house which the Texas & New Orleans Ry. is to build in Beaumont will cost about $50,000. It is to be a brick structure two stories high. M. L. Champion will have charge of the construction work.

BLOOMINGTON, ILL.—A union station may be built at this place by the Lake Erie & Western and the Cleveland, Cincinnati, Chicago & St. Louis. It is said that land has been bought for this purpose.

CHICAGO, ILL.—The Chicago Terminal Transfer R. R., it is reported, has plans ready for a large freight house 40 ft. x 700 ft., at Polk and Franklin streets. A freight house is also to be built at Franklin and Harrison streets for the Pere Marquette.

FORT WORTH, TEXAS.—The Northern Texas Traction Company, it is reported, has bought land 150 ft. x 320 ft., on which it will build a car house at a cost of about $35,000.

HAZLETON, PA.—Plans, it is reported, are being made for a two-story brick and steel addition to the machine shops of the Wilkesbarre & Hazleton R. R. New machinery will also be added.

LEWISTOWN, PA.—The Pennsylvania, it is reported, will build a new passenger station of brick, one story high, 20 ft. x 80 ft.

MUNCIE, IND.—A contract, it is reported, has been let by the Indiana Union Traction Co. for its new terminal station, a building of five stories of stone, brick and steel, to Fred. Illingsworth & Co., of Muncie.

NEW HAVEN, CONN.—The Fair Haven & Westville R. R. Co. has under consideration the building of car barns 120 ft. x 300 ft., to be of brick and steel.

NEW YORK, N. Y.—Local reports say that the New York Edison Company will build a four-story power house on the south side of 27th street, immediately in the rear of, and as an annex to its big power house in 26th street. The new building is to be 44 ft. x 95.9 ft., of brick, to cost about $85,000.

PASADENA, CAL.—The Southern Pacific has petitioned the city for permission to lay tracks to cross Glenarn street, to reach the site of the proposed roundhouse to be built in South Broadway.

SMITH'S COVE, WASH.—Press reports from St. Paul state that the Great Northern will spend about $1,000,000 on its Pacific Steamship terminus which will be begun within the next year and a half, during which time Smith's Cove harbor will be improved. A sea wall is to be built of concrete and stone protecting the company's wharves. Another wharf will be added to those now existing.

SPENCER, N. C.—The Southern, according to reports, will build additions at its Spencer shops.

TACOMA, WASH.—The Pacific Power Works Company, it is reported, will build a plant in this city to have a capacity of 10 cars daily.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALBANY & NORTHERN.—An amendment has been made to the charter of this company providing for an extension from Cordele, Ga., northeast via Hawkinsville to Jeffersonville, 60 miles. It is stated that work on this extension will shortly be begun. J. S. Crews, Albany, Ga., is General Manager.

ATLANTIC SHORE LINE (ELECTRIC).—Reports state that work will shortly be begun on this proposed electric railroad from Biddeford, Me., southwest through Kennebunkport to York, 30 miles. A. W. Merrill, Portland, Me., is said to be interested.

CANADIAN PACIFIC.—This company's plans for building lines in western Ontario which have been published in recent press reports include the following: Extension of the Guelph branch from Guelph, west through Elmira and Milverton to Goderich, 75 miles, and an extension from Kleinburg, on the Toronto, Grey & Bruce Division, northwest to Sudbury.

CHICAGO & ALTON.—Grading is reported practically completed on the cut-off which is being built from Mexico, Mo., southeast to Old Monroe, 63 miles. Albert Newman, Mexico, Mo., is in charge of the work. The line, when completed, will be used jointly by the Chicago & Alton and the Chicago, Burlington & Quincy.

CHICAGO, ROCK ISLAND & PACIFIC.—The newspapers say that this company is relaying its line from St. Joseph, Mo., southwest to Topeka, Kan., 89 miles, with 85-lb. rails, in place of the 60-lb. rails now in use. The track is also being rock ballasted and it is expected when the work is completed to run the freight and heavy through traffic from Chicago over this division.

CLARION & PITTSBURG.—Grading is reported in progress on this proposed line from Clarion, Pa., east via Corsicana, Day and Strattonville to Mechanicsville, 17 miles. Bennett & Co., of Clarion, are the contractors. The work will be light. C. F. Heidrick, Brookville, Pa., is President. (Sept. 4, p. 642.)

CLEARFIELD SOUTHERN.—This company has filed a notice with the Secretary of State of Pennsylvania applying for authority to build an extension of its line from the mouth of Little Clearfield Creek to Irvona, 30 miles. The road was recently purchased by the New York Central & Hudson River, and is to be operated as a part of its Pennsylvania division. (Oct. 2, p. 714.)

COATZACOALCOS, YUCATAN & GUATEMALA.—Work has been begun on this proposed railroad from Coatzacoalcos, in the State of Tabasco, Mexico, through Campeche to Merida, the capital of the State of Yucatan, 600 miles. P. O. Saunders, Mexico City, is interested. (Sept. 18, p. 680.)

DENT'S RUN.—An officer writes that this company, which recently obtained a charter in Pennsylvania, completed its railroad between Dent's Run and Wilmers, six miles, some time ago, but that the owners never formed a corporation until now. C. L. Munson, Williamsport, Pa., is President. (Oct. 9, p. 730.)

FLORIDA EAST COAST.—Work is reported in progress on the extension of this road from Miami, Fla., southwest to Cape Sable, 75 miles. Grading has been completed to Perrine, 17 miles from Miami. E. B. Carter is in charge of the work.

IMBODEN & ODELL.—It is reported that the contract for grading 10 miles of this road has been let and that the balance will be let in 10-mile sections as soon as the location surveys have been completed. The proposed route is from Charleston, W. Va., east to Summersville, 35 miles. C. P. Peyton, Charleston, W. Va., is Chief Engineer. (May 8, p. 336.)

INDIANA CENTRAL TRACTION.—Articles of incorporation have been filed by this company in Indiana. It is proposed to build an electric railroad from Wabash north through North Manchester to Warsaw, 30 miles. The new line will parallel the Cleveland, Cincinnati, Chicago & St. Louis between these points. V. J. Draper is President; L. A. Bookwalter, Vice-President, and W. C. Teeter, Secretary, all of Dayton, Ohio.

LIVE OAK & PERRY.—Incorporation has been granted this company in Florida to build from Live Oak, southwest to Perry, 50 miles. M. L. Clegg, T. B. Dowling, O. D. McFarland and others, of Live Oak, are interested.

MEXICAN ROADS.—Application has been made to the Mexican Government for a concession to build a railroad from Mazapil, in the State of Zacatecas, northwest to Camacho, 25 miles.

The Mexican Flume & Lumber Company will begin work at once on a railroad from Quirio, in the State of Michoacan, Mexico, southeast 15 miles, to extensive timber lands owned by the company.

The Mexican Government has granted a concession for building a railroad from Xuchiles, in the State of Vera Cruz, to Juan de la Punta. Surveys are now being made.

Application has been made to the Mexican Government, by Alberto Morales for a concession to build a railroad from Durango, in the State of Durango, northwest to the port of Guaymas, 300 miles.

NEW YORK, NEW HAVEN & HARTFORD.—The contract for extending the second track of the Naugatuck Division from Ansonia, Conn., north through Naugatuck to Winsted, has been let to the J. J. O'Brien Contracting Company, of Bridgeport. It will take about six or eight months to complete the work.

NORWOOD & ST. LAWRENCE.—It is stated that an extension will shortly be built from Raymondsville, N. Y., to the St. Lawrence River, 12½ miles. The road runs at present from Raymondsville via Norfolk to Norwood, seven miles. C. H. Remington, Watertown, N. Y., is President and General Manager.

PITTSBURG, CINCINNATI, CHICAGO & ST. LOUIS.—Preliminary surveys are now being made for building a second track on the Cincinnati Division between Foster, Ohio, and Morrow, 10 miles.

RALEIGH & SOUTHWESTERN.—Incorporation has been granted this company in West Virginia to build a railroad from Beaver Creek, in Nicholas County, southwest to the mouth of Soak Creek, near Beckley, in Raleigh County, 40 miles. C. H. Krise, H. Allen and others, of Raleigh, W. Va., are incorporators.

SAN FRANCISCO & NORTHWESTERN (ATCHISON, TOPEKA & SANTA FE).—Press reports state that Chief Engineer Storey, of the Santa Fe, is now superintending surveys in Humboldt and Mendocino Counties, Cal. The proposed route is from Alton, in a southerly direction to a connection with the Atchison at Point Richmond, opposite San Francisco, 200 miles. Five surveying parties are now in the field. (July 10, p. 520.)

SHAWNEE & NORTHWESTERN.—Articles of incorporation have been filed by this company in Oklahoma Territory to build a railroad from Wichita Falls, Texas, to Claremore, Ind. T., 600 miles. The names of the incorporators are not stated.

SILVERTON & NORTHERN.—Grading has been practically completed on the extension from Eureka to Ammas Forks, Colo., four miles. Alexander Anderson, Silverton, Colo., is General Manager.

SOUTH CAROLINA ROADS.—It is reported that surveys have been finished for a railroad from Green Sea to Howard, S. C., six miles. J. P. Derham, Green Sea, is President.

SUSQUEHANNA RIVER & WESTERN.—The reconstruction of this line, which was formerly the Perry County R. R., will be begun at once. The road runs from Duncannon, Pa., to Landisburg, 23 miles, and was recently sold under foreclosure. David Gring has been elected President.

TENNESSEE CENTRAL.—Track has been laid from Nashville, Tenn., to Clarksville, 53 miles. The remainder of the road from Clarksville to Hopkinsville, Ky., 30 miles, has been graded, and it is expected that the entire line will be ready for business before the end of the year. (Aug. 21, p. 610.)

TOLEDO, COLUMBUS & CINCINNATI (ELECTRIC).—Articles of incorporation have been filed by this company in Ohio. It is proposed to build an electric railroad from Cincinnati north through Columbus to Toledo, 250 miles. C. H. Headler, C. L. Held, H. J. Pervis, T. O. Wright and others, of Toledo, are incorporators.

TOLEDO SOUTHERN.—Incorporation has been granted this company in Ohio to build a railroad from Hamler, in Henry County, northeast through Henry, Wood and Lucas Counties to Toledo, 40 miles. The proposed line parallels the Cincinnati, Hamilton & Dayton for the greater part of the distance. N. S. Monsarrat, J. H. Doyle, C. T. Lewis and John W. Schauffelmyer, of Toledo, are incorporators.

WHEELING, WAYNESBURG & EASTERN.—It is reported that this company has again applied to the city council for the rights for a line into Wheeling, W. Va. The report also states that although the company was affected by the failure of its former financiers, Hurlbutt & Hatch, of New York, it has made arrangements with another firm who will provide for the commencement of work on the road as soon as the franchise has been acquired.

WICHITA, ARKANSAS VALLEY & DENVER.—A charter has been granted this company in Kansas to build a railroad from Denver through the States of Colorado and Kansas to a point in Indian Territory. The estimated length of the proposed line is 650 miles. W. F. Brown, A. J. Roy and C. A. Lathan, all of Wichita, Kan., are incorporators.

WICHITA VALLEY.—The newspapers say that an extension will shortly be built from Wichita Falls, Texas, northeast to Benvanue, Clay County, 20 miles. The road at present runs from Seymour to Wichita Falls, 52 miles. Morgan Jones, Wichita Falls, is President. (See Construction Supplement.)

WISCONSIN ROADS.—Press reports state that a railroad will shortly be built from Madison, Wis., northeast through Oshkosh to Green Bay, 150 miles. Surveys will be begun at once. H. S. McFall, Cleveland, Ohio, is said to be interested.

GENERAL RAILROAD NEWS.

DAKOTA PACIFIC.—This road, which runs from Rapid City, S. Dak., to Iron Creek, 10 miles, has been purchased at receiver's sale by C. D. Crouch, of Akron, Ohio. The road has been graded as far as Mystic, S. Dak., 32 miles from Rapid City, and it is the intention of the new owner to complete the line to Mystic as soon as possible.

GEORGIA SOUTHERN & FLORIDA.—Gross earnings of this company for the fiscal year ending June 30 were $1,635,191, an increase of $384,315. Operating expenses were $1,234,402, an increase of $278,496, leaving an increase in net earnings of $105,819. The heavy increase in cost of transportation was due to a large increase in the cost of fuel for locomotives. The total number of miles operated was 392 as against 285 miles the previous year. This increase in mileage was due to the acquisition of the Atlantic, Valdosta & Western, Valdosta to Grand Crossing, 106 miles.

INDIANA, ILLINOIS & IOWA.—This company has increased its capital stock from $4,000,000 to $6,000,000. The proceeds will be used towards building an extension from the present terminus at Benton Harbor south to points in southwestern Michigan.

LEHIGH & NEW ENGLAND.—This company has merged with itself its proprietary line, the Northampton R. R., and has made a consolidated 5 per cent. mortgage for $3,000,000, covering both properties. Of the new bonds, $1,300,000 will be issued to retire the present outstanding bonds of the Lehigh & New England, due in 1945, and of the Northampton R. R., due in 1952. The remainder ($1,700,000) will be used for extensions and improvements.

LEHIGH VALLEY.—This company has filed a mortgage for $150,000,000 with the Girard Trust Company of Philadelphia. The mortgage is a general consolidated mortgage covering the railroad property, assets and franchises of the Lehigh Valley Railroad, the stock of the Lehigh Valley Coal Company, and the other stocks owned by the parent corporation. It is intended to issue $10,000,000 of the new bonds at once.

LOUISVILLE & NASHVILLE.—The report of this company for the fiscal year ending June 30 shows gross earnings of $35,449,377, an increase of $4,737,120. Operating expenses were $23,970,812, and net earnings were $11,478,565, an increase of $1,669,746. The total number of tons of freight carried was 20,677,836 as compared with 18,320,972 tons in 1902. After paying the regular 5 per cent. dividends on the common stock, the company had a surplus for the year of $3,211,047.

NORFOLK & WESTERN.—At a recent meeting of the stockholders of this company the acquisition of several roads in the mining district of West Virginia and Kentucky was approved. The roads acquired are as follows: Kenova & Big Sandy, 59 miles; Guyandotte & Tug River, 66 miles, and the Iaeger & Southern, five miles.

TOLEDO, ST. LOUIS & WESTERN.—Gross earnings of this company for the fiscal year ending June 30 show an increase of $470,478. Operating expenses increased $341,543, leaving an increase in net earnings of $128,936. Eastbound tonnage increased 251,301 tons, and westbound increased 144,858 tons. The train load for the year was 295.7 tons as against 285.5 tons in 1902. The company set aside the sum of $88,935 towards the renewal fund.

WABASH.—The gross earnings for this company for the fiscal year ending June 30, 1903, were $21,140,829, an increase of $2,087,335. Operating expenses were $15,815,662, an increase of $1,968,266, leaving an increase in net earnings of $119,109. Of the increase in gross receipts, freight traffic contributed $1,563,927, and passenger traffic $2,355,260. Maintenance of way expenses show an increase of $782,547. "Conducting transportation" increased $681,318, and maintenance of equipment $458,545. After paying interest on bonds, and the dividends on preferred debenture bonds, the surplus was $196,150.

WHEELING & LAKE ERIE.—Joseph Ramsey, Jr., President of the Wabash, is quoted as saying: "At the present time we are working a plan for the consolidation of corporations formed in Ohio, Pennsylvania and West Virginia. These concerns were incorporated in those States to build the Pittsburg extension or what is generally known as the Pittsburg, Carnegie & Western, 60 miles in length. The Wheeling & Lake Erie will be merged with these lines and, in the end, it is likely that the Wabash will lease the consolidated company."

YOUNGSTOWN & SOUTHERN.—This company has been consolidated with the Youngstown & Salem under the name of the Youngstown & Southern R. R. Co. The capital stock of the combined companies is $1,800,000. A. W. Jones, Youngstown, Ohio, is President.